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Splashing of Meat in the Slaughter of Animals.

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Those concerned in the slaughter of animals for food have long been familiar with the occasional occurrence of hæmorrhagic spots or streaks in some part of the carcass, and the term " splashing " has been applied to the condition. These spots are most commonly found in the diaphragm, abdominal wall, dorsal muscles and loin, the first-named being the commonest site; they are true extravasations of blood due to rupture of vessels, and their presence renders meat unsightly, especially after cooking. " Splashing " is of greater importance, however, in that the presence of an undue amount of blood renders the meat more liable to early decomposition. Despite the economic problem involved and the fact that the condition has been recognised for so long a time, little or no serious investigation of the phenomenon has been undertaken, and any references to the subject in the literature have been the outcome of controversy over the use of mechanically-operated instruments in slaughter[1, 2, 3]. Most observers are agreed that " splashing " does not occur in animals bled to death without previous shooting or stunning, but, on the other hand, the condition is only seen in a small proportion of those which have been stunned or shot before bleeding, so that " splashing " cannot be attributed solely to the act of stunning whether by poleaxe or otherwise.

There are two views which, up to the present, have been advanced in explanation of " splashing." Wooldridge, in 1922[4], and Parker, in 1929[2], stressed the importance of delay between stunning and bleeding as a cause, while Dunkin and Hill[1] were of opinion that the violent muscular contractions seen in shot animals were responsible for the condition.

Observations over a long period of time, however, of the slaughter of cattle, sheep and pigs, led one of us (W. T.) definitely to the conclusion that the interval between stunning and bleeding may be delayed as long as five minutes without the occurrence of any splashing, while the condition could be found in animals bled within a quarter of a minute of being stunned. Moreover, very violent convulsive movements were possible after shooting without any signs of subsequent splashing. In one long series of cases where the animals were hoisted by the hind legs and bled without previous stunning and where the struggling was very violent, no single case of " splashing " was seen. It is evident, therefore, that neither of these factors alone can be accounted the *cause* of " splashing," although it is obvious that, where " splashing " has occurred, delay in bleeding increases the *extent* of the hæmorrhages.

So far as we are aware, no observations have been made on changes of blood pressure which occur when an animal is stunned; yet it seemed to us that an investigation of these changes was of prime importance, for " splashing " might be due, in some measure at least, to an excessive rise of pressure either arterial, venous, or both. A series of experiments was therefore made (by G. A. C.) on sheep, in which arterial and venous pressures were simultaneously recorded immediately before, during, and after shooting with a captive bolt pistol. The sheep was comfortably trussed on a table and the left side of the neck was anæsthetised in layers by injection of Codrenine; a skin incision of three inches allowed exposure of the external jugular vein and the carotid artery, and into each of these was tied a cannula connected to a mercury manometer the movements of which were recorded in the usual way on a revolving smoked drum.

The normal arterial pressure under these conditions was found to vary between 120 and 145 mms. Hg., while the venous was between 0 and 3 mms. Hg. As soon as the pressures were steady the sheep was shot in the routine way in the mid-line of the frontal region, the animal being held to prevent dragging of the cannulæ connections which might occur as the result of convulsive movements.

Fig. I is typical of the effects produced; immediately the shot was fired the arterial blood pressure rose, sometimes to more than double the initial value, and there was considerable cardiac acceleration; respiration either ceased at once or after a few gasps, but returned again after a varying interval; the venous pressure began to rise as soon as respiration stopped. Arterial pressure was maintained for a short time, then began to fall, but the onset of slow, deep and irregular respirations produced corresponding fluctuations in blood pressure which in some cases did not fall to the initial level for several minutes. The cardiac acceleration observed often did not appear till the blood pressure had nearly or actually reached its highest point, and contributed little, if at all, to the rise. It appeared, in fact, that at the increased rate the heart was less efficient, because it was generally accompanied by an increase in venous pressure.

From a survey of the experimental results, it is evident that there is no correlation between *degree* of rise in arterial or venous pressure and the incidence of " splashing "; nor is the abruptness of the rise a factor. This is clearly evident from a comparison of Figs. I and II; the animal from which Fig. I was obtained was very badly " splashed," while there was no " splashing " in that which gave Fig. II. In these two cases not only is the rise in pressure approximately the same, but the association of high arterial with high venous pressure is evident in each case. If, therefore, increased pressure was the main factor involved, " splashing " would be expected to occur in both of these animals and probably to a greater extent in the second, because of the more maintained rise of pressure. Another point of interest is that in Fig. I the length of bolt used was 1½ inches, while that in Fig. II

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was ½ an inch. Two-and-a-half minutes after shooting in the latter case the arterial pressure had fallen only to 200 mms. Hg., and at this point the sheep was shot a second time using a bolt 1½ inches long. This resulted in a further rise of blood pressure to 260 mms. Hg. Only the effect of the ½-inch bolt (which caused complete loss of consciousness) is shown in Fig. II. In each case, so far as gross examination of the brain showed, the destruction of tissue was the same.

From the experiments quoted above, and from others in the series, it appeared that neither rise of blood pressure nor occurrence of " splashing " could be correlated with length of captive bolt used, at least up to a length of 1½ inches in sheep.

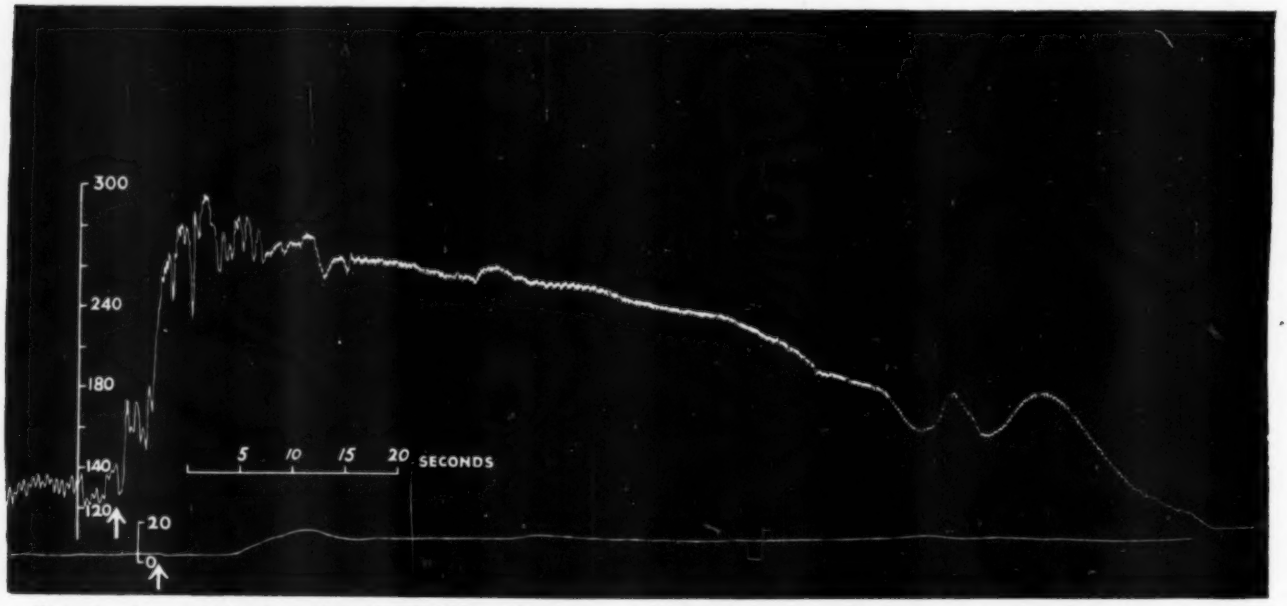

Fig. I.—Arrow indicates point of shooting. Upper record—arterial pressure. Lower record—venous pressure. Length of Bolt 1½-in. Considerable splashing present.

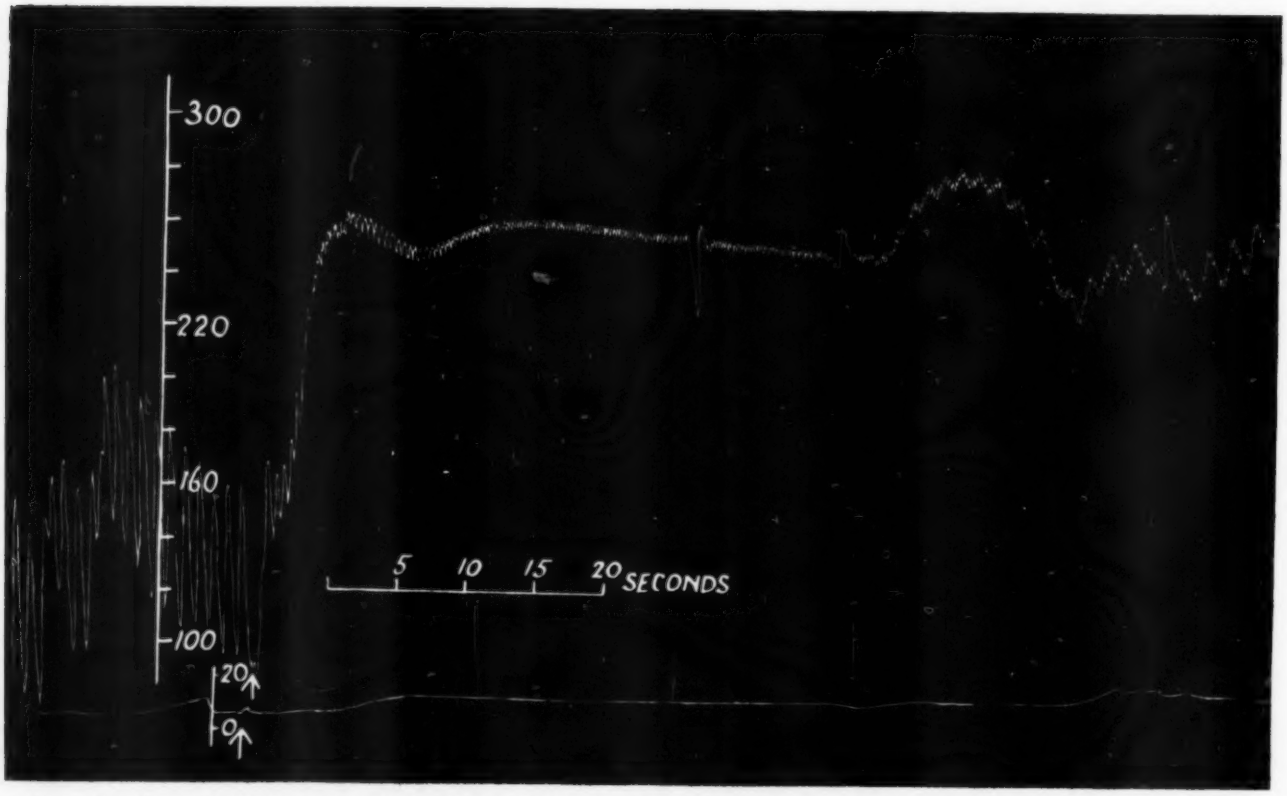

Fig. II.—Arrow indicates point of shooting. Bolt ½-in. Shot 2½ minutes later when B.P. 200, giving further rise to 260 (bolt 1½-in.) No splashing.

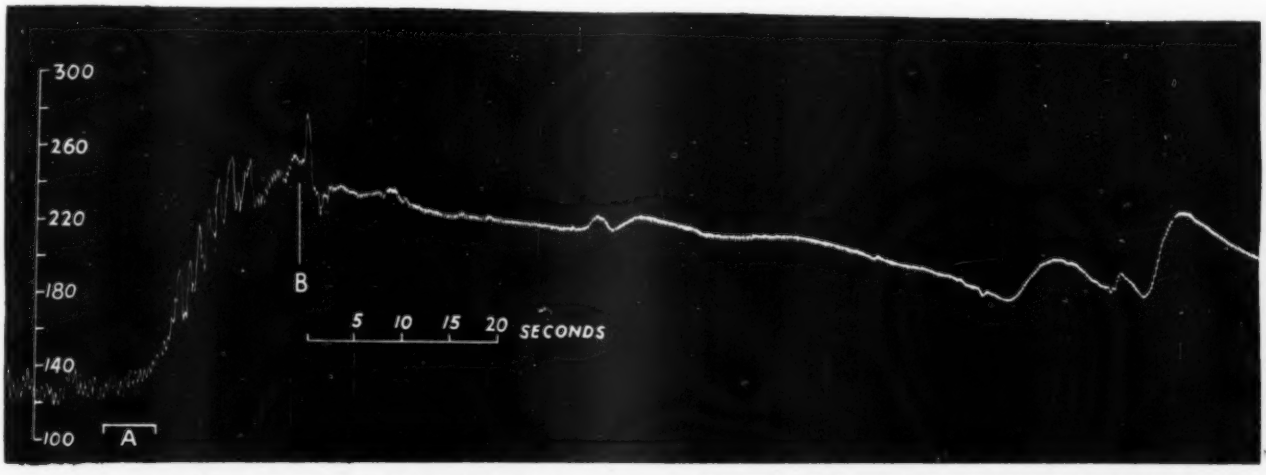

Fig. III.—1 c.c. $\frac{1}{1000}$ Adrenaline injected intravenously at A. Animal shot at B. No splashing.

An attempt was made in one experiment to get a minimum rise of pressure on shooting by injecting intravenously 1 c.c. of adrenaline (1 in 1,000) and shooting when the rise in pressure was at its highest point; the result is given in Fig. III. It will be seen that the adrenaline had apparently produced a maximum rise in pressure, but subsequent shooting greatly increased the heart rate. There was no " splashing " in this animal.

The muscular movements seen after shooting varied considerably, and it was not possible to correlate the extent of gross convulsive movements with " splashing." It is, however, extremely difficult to judge intensity of muscular contractions merely by observation, more especially when the movements are being restrained as in these experiments, and it may well be that, with efficient assistants, practically no gross movements occur, although intense contraction of muscle is taking place. It is of some importance to record that the incidence of splashing in these experimental animals was much higher than that found in the routine slaughtering at the time and an important difference in the two conditions is that in the experimental series the movements of the animal were being efficiently restrained immediately on shooting.

Although the purely experimental investigations had clarified many previously obscure points of the problem, we were driven for further information to make observations on the animals killed in the ordinary abattoir routine. It was noticed that a higher proportion of " splashed " carcasses resulted from animals which had had a long journey by rail or otherwise immediately prior to slaughter. Moreover, there was a high incidence in animals which were difficult to drive into the slaughter trap or which escaped and had to be chased a longer distance. The noise of machinery and the sound of pistol reports apparently frightened the animals awaiting slaughter, and we considered the possibility of fear as a factor producing " splashing," but observation showed that this fear in many cases resulted in difficulty in handling and therefore led to muscular exertion prior to death, so that fear may be a factor only in so far as it is productive of fatigue. On the other hand, if Cannon's view of adrenaline production in emotion is valid, fear itself may be a factor of direct importance[5].

The routine practice in the Sheffield abattoir is to drive the animal into a trap, shoot it, release the trap and hoist the animal head downwards over a bleeding trough after it has rolled out on to the floor. The majority of animals have convulsive movements of varying degree when they roll out of the trap, but others do not begin to struggle until they are being hoisted. The movements of an animal struggling on the floor are restricted only by the weight of its limbs, but the movements when an animal is hoisted are restricted by the weight of the entire animal so far as the loin muscles are concerned, and in the case of the diaphragm by the weight of the abdominal contents. It is unusual to get rupture of blood vessels by muscular exertion during normal life, but the chance of this accident occurring is very greatly increased if the blood vessels are distended with blood and the muscular contractions are violently convulsive in type. In animals stunned, whether by poleaxe or pistol, the blood pressure is raised as already described. This rise, produced by irritation of the nervous system, is mainly due to vaso-constriction in the splanchnic area[6], so that it will tend to drive more blood into the vessels of muscular tissue which are ill-supplied with vaso-constrictor nerves, and which appear to respond to nervous stimulation by dilation rather than by constriction[7, 8]. In the case of animals fatigued before being shot, the muscles would already contain more blood than in the resting condition, thus aggravating the engorgement subsequent to shooting. It is perhaps of importance to mention here that only once have we seen signs of hæmorrhage in the mesentery or intestines, and this consisted merely of two small spots in the great omentum.

In our experimental series were several cases where a considerable amount of struggling occurred prior to shooting, but in none of these did the blood pressure rise to the height seen after shooting. We can thus explain the absence of splashing in those animals already mentioned which were hoisted and bled without previous stunning in that in these cases the high pressure factor is less in evidence, while the muscular movements would be better co-ordinated. In the head-down position in animals with brain undamaged by stunning, vaso-motor reflexes would be brought into play, tending to reduce any increases of blood pressure caused by struggling[9, 10].

Although we were unable experimentally to correlate degree of rise of blood pressure with incidence of splashing, we consider increased pressure an important factor when associated with fatigue or muscular exertion producing

engorgement of vessels in muscle. When violent irregular contractions occur in muscle thus engorged, we believe the combination is such as to produce a maximum incidence of splashing. A reduction in intensity in any of these factors will reduce the incidence of splashing in varying degree. It has been found, for instance, that if cattle are bled without previous hoisting the number of cases of splashing is appreciably reduced; this is not merely because of the reduction in time between stunning and bleeding, because our previous observations have shown that such reduction diminishes *extent* but not *incidence* of splashing. We have not been able experimentally to reduce the degree of rise of blood pressure produced by shooting either by varying the length of bolt or the point of entry of the bolt into the skull; the point of entry, however, was only varied within a very circumscribed area of the frontal region.

A point of some interest is the fact that splashing is rarely if ever seen in calves, and in two of these animals whose blood pressure we investigated after shooting there was actually a fall in blood pressure in one, while in the other an immediate fall was succeeded after 30 seconds by a slight rise which never exceeded 180 mms. Hg.; no appreciable acceleration of the heart occurred in either case.

The histological aspect of the subject was next investigated (by J. W. E.). Sections were prepared from portions of muscle removed from animals stunned before bleeding (in this case the captive bolt pistol or gun was used) as well as those killed by direct bleeding, as in the Jewish method of slaughter. These specimens, if taken for comparative purposes, were always obtained from the same site, usually the diaphragm or loin muscles. The animals examined were bovines, sheep and pigs. The chief difference noted was that in animals stunned before bleeding the small arteries and veins as well as the capillaries contained blood, whilst in those killed by direct bleeding these vessels were quite empty. The larger arteries and veins were usually empty in both cases. This vascular engorgement was particularly stressed in a paper by Dunkin and Hill[1], and Ducksbury and Anthony[11] have shown by physico-chemical means that the blood content of muscles from animals stunned by electricity before bleeding was very much greater than that of muscles from animals killed by direct bleeding.

The hæmorrhages which constitute the condition known as splashing were also investigated by means of serial sections. Some were merely microscopic in size and appeared to be due to an extravasation of blood from the capillaries. Whether the blood escaped following rupture of the capillaries or by passing between adjacent endothelial cells is difficult to decide on account of the small size of the vessels and the thinness of their walls. The ordinary "splash" as detected by the naked eye arises from the smaller arteries and veins and there is a certain correlation between the size of the vessel and the size of the hæmorrhage. Other factors, however, operate in determining this, *viz.*, intravascular pressure, delay in bleeding, and the external pressure exerted on the vessel by the surrounding tissues.

It is possible to find the site of rupture by means of serial sections, and this often takes place where the vessel branches or takes a sharp turn. The rupture may involve the whole transverse section of the vessel (photo 1) or may only be a lateral tear (photo 2).

No. I.—Lateral rupture of a vessel. × 520.

No. II.—Transverse rupture of a vessel. × 600.

The lateral tear invariably occurs near where the vessel branches or bifurcates. At the site of rupture there is an area of amorphous material, fibrin, disintegrating cells and blood platelets, whilst external to this is a collection of leucocytes intermingled with a few red blood corpuscles. The majority of the red corpuscles are to be found still more widely dispersed and are seen between the muscle fibres and bundles as well as along the line of the blood vessels. The muscle bundles were also examined in detail to see how much muscle rupture was present. This was

not nearly so marked as expected, though it did occur. Great care had to be exercised not to mistake tearing of the muscle bundles, due to the microtome knife, for true rupture. If the latter took place the gap between the torn ends of the muscle was occupied by some blood corpuscles, whilst if the rupture was due to the cutting of the section this did not occur.

The fact that both arteries and veins are found ruptured in the same animal favours the view that simple rise in blood pressure is not the sole factor involved.

Summary and Conclusions.

An attempt has been made to determine the factors responsible for "splashing" in meat; observational and experimental methods have been used.

Delay in bleeding after stunning with a mechanical killer does not *cause* "splashing" but merely increases its extent.

In our opinion there is no single cause of "splashing"; the condition is produced by an association of factors of which violent inco-ordinated muscular contractions and engorgement of muscle vessels at a higher pressure than normal are the most important.

These main factors may be produced or aggravated by several conditions; intensity of muscular contractions may be increased by restraint or the position of the animal; muscular engorgement may be accentuated by previous exertion or perhaps by fear and also by high blood pressure.

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Application of Knowledge on Nutrition.

For the purpose of advising the Minister of Health on the practical application of modern advances in the knowledge of nutrition, the Minister has appointed an Advisory Committee comprising the following members:—

Professor Major Greenwood, F.R.C.P., F.R.S. (Chairman); Professor E. P. Cathcart, C.B.E., M.D., F.R.S.; Sir F. Gowland Hopkins, F.R.C.P., F.R.S.; Miss Jessie Lindsay; Professor E. Mellanby, M.D., F.R.C.P., F.R.S.; Professor V. H. Mottram, M.A.

The Members will hold office until December 31st, 1933, and will be eligible for re-appointment.

The Secretary to the Committee will be Mr. F. R. Hudson of the Ministry of Health.

Malayan Veterinary Quarantine Stations.

During 1929, states a Federated Malay States official report, 10,544 animals were imported through quarantine stations in Perak, 44,410 in Selangor, 2,268 in Negri Sembilan, and 4,458 in Pahang. Animals to the number of 18,774 of the Selangor importations arrived *via* Port Swettenham.

The Horse and his Economic Usage.*

By Major-General Sir John Moore, K.C.M.G., C.B., F.R.C.V.S.

In these days of motor traction and mechanised appliances generally, there are people who, without any particular considered opinion, or whose prejudice has become an obsession, would have us believe that the horse is now an anachronism, that he has outlived his day, and that his place is now the museum. The same class of person would not admit that by reason of mechanical invention or substitution the human being has outlived his or her utility. To minds so obscured I would suggest that, whatever the benefits of mechanical invention aiding to convenience, the basic fact of flesh and blood, or the products of Nature, will continue to maintain a predominant rôle and be omnipresent. Animals under domestication all have their uses and their special rôles; it only remains for man to direct such into the most efficient, suitable, convenient and economic channels. Moreover, in National services, conceived on the broad basis of commerce and industrial undertakings, there can be no monopoly in procedure, and obviously the best method or combination of methods is that whereby the greatest economy in working can be achieved, and the best resultant dividends affected. I hope to show in the course of my remarks that the horse does fulfil his rôle as an economic factor in commercial life, and that horse transport for certain categories of work carries an economic advantage over motor transport, its rival and part supplanter.

First of all, let me dispose of the most unjust and insensate cry of debarring horse transport from the streets of London during the rush hours of passenger traffic, on the plea that the slow-moving horsed vehicles impede the progress of the faster-moving motor vehicles, and lead to traffic blocks. There never was a greater fallacy nor more untrue statement, which an ordinary unbiased observer can verify for himself by visiting any of the main passenger traffic routes in the Metropolitan area during the busy times of the day. Traffic blocks and holds-up on our main passenger thoroughfares are directly due to the large and increasing volume of motor vehicular traffic, the large motor buses, private motor cars, taxis, motor vans, motor lorries and motor coaches. The situation is made more difficult by reason of the vast number of people visiting shopping centres and the necessity for their safety in crossing streets at various points.

London's Traffic Problem.

An idea of the large volume of London's traffic may be gathered from the Scotland Yard annual traffic census taken on the second Tuesday of July, the count being taken at 98 different points from 8 a.m. to 8 p.m. On July 9th, 1929, which is the last census available, 2,198,713 vehicles of all kinds were counted, of which 209,287 were heavy motor cars and lorries, 67,111 light horsed vehicles,

* Issued by the National Horse Association of Great Britain, 12 Hanover Square, London, W.1, where reprints of this article may be obtained.

72,598 heavy horsed vehicles, or a total of 348,996 which might be legitimately classed as commercial vehicles, leaving 1,849,717 as representative of passenger conveyance. It will, of course, be understood that in transit across London individual vehicles may be counted several times.

According to Police records, the busiest traffic centre in the Metropolitan area is Hyde Park Corner. On July 9th, 1929, there passed through that place in the twelve hours from 8 a.m. to 8 p.m. the stupendous number of 72,685 vehicles of all kinds, of which 4,231 were heavy motor cars or lorries, and 1,908 were horsed vehicles, the balance of 66,546 representing for the most part passenger traffic.

The figures in respect of horsed vehicles are not to be taken as a true guide as to the number of horses employed in the commercial life of London, nor as indicative of a large decrease in horses in recent years. Horses are used for comparatively short distance local trade. Horse transport studiously avoids the main thoroughfares, and makes the best possible use of less frequented streets to which they are more suited and along which they can ply with greater comfort to themselves and economy to the commercial firms employing them. Horsed transport at times must cross main passenger traffic routes, but it can do so at equal pace with other forms of transport and no delay or block is occasioned. Indeed, the invariable rule is for the slower moving horse transport to hug the near-side kerb whenever entering or emerging from main thoroughfares, allowing faster moving motor vehicles to pass.

It may be remarked that the best comparative estimate of motor versus horsed transport in ordinary trade may be gathered from returns of cross-river traffic. The Tower Bridge is most interesting in this respect, traffic over that Bridge by rule and regulation being in one continuous stream, an arrangement which is most perfect in execution. On July 9th, 1929, between 8 a.m. and 8 p.m. there passed over the Tower Bridge a total of 14,264 vehicles, of which 2,845 were heavy motor cars and lorries, and 5,053 were horsed vehicles. The Tower Bridge is an object lesson in traffic, slow moving vehicles keeping to the kerb, and fast moving vehicles proceeding down the centre.

I have thought it necessary to preface my remarks with a short account of London's traffic, a problem which presents difficulties of an increasing rather than a diminishing nature, and which have a distinct economic bearing on the general use of transport of carrying companies and business firms.

Success of common trade and commercial undertakings from a transport point of view depends on four main factors:—

(*a*) Ability to move from point to point without the delay occasioned by traffic impediment.
(*b*) Distance to be covered, or what might be termed the radius of service.
(*c*) Adaptibility.
(*d*) Relative cost.

For practical purposes the whole subject of Transport Economics can be discussed under the above headings, and Horse versus Motor Transport in particular.

Ability to Move from Point to Point.

The police traffic census sufficiently shows the disability under which commercial transport labours in the Metropolitan area, and there can be no doubt that the enormous increase of motor transportation for all purposes creates its own delay and defeats its own specific object. The reduction of speed to less than horse pace or walking pace is only fruitful of annoyance, and carries no recommendation in point of business economy. Quite recently, travelling by 'bus, I spent 10½ minutes on a journey from Piccadilly Circus to Oxford Circus, and 11 minutes from the latter place to the 'bus stop in Orchard Street, or 21½ minutes for a distance of little over a mile.

The unwisdom, therefore, of commercial transport getting mixed up with the essentially passenger traffic on main scheduled thoroughfares is apparent. Better progress can be made in streets collateral to main passenger routes, and it is to this rule of road that horse transport can quietly and efficiently carry out the duties required of it. Excepting when deliveries have to be made, or crossings effected, the crowded passenger traffic thoroughfares are avoided as much as possible. In local service, or carrying work from railway station to railway station in the Metropolis, drivers know exactly the best routes to follow, and where horses can even trot when desired. And what holds good in London applies equally to large provincial cities and towns. Impediment of motor traffic drives horse transport to less frequented streets and to its advantage, convenience and working economy.

Radius of Service.

It is now generally accepted that the most profitable utilisation of horses in commercial activity lies within a radius of four to six miles. Some carrying firms in London operate in an eight-mile radius, their horses covering as much as twenty miles per day, while local tradesmen, retail houses of business, and municipalities may confine the area for their horse transport to a three-mile or even as low as a two-mile radius. Horses, though they may have long hours, are not intended for long-distance work, which, on a straight-away run, obviously comes more properly within the sphere of motor transportation.

Adaptability.

There can be no question that in the common commerce of large cities and towns the horse and horse transport is most adaptable, handy, convenient, and reliable. In this connection it is interesting and instructive to refer to the experience of a large business firm which has been in existence for over a hundred years, and which employs both motor and horse transport. Sir William Acland, Bart., a Director of Messrs. W. H. Smith and Son., Ltd., in a well-reasoned article entitled "Some thoughts on the Horse in relation to modern transport problems" (copies of which can be obtained gratis from the National Horse Association) says: "Our motor traffic has increased, but it has increased beyond the comparatively short radius for which horses are primarily more suitable. In the old days horses used to travel 20 to 30 miles per day. Now-a-days on straight away runs it is better to use a car. On the other hand, for short runs, particularly where there are many stops, and where the normal traffic of the road is such as to prevent a car developing anything like its maximum speed, a horse is to be preferred. In the narrow turnings and courtyards such as abound in the city, and in those parts of London where newspaper and book publishers' presses are busy during most of the 24 hours, there is a tremendous advantage, often unrealised by the general

public, that a horse-drawn van with its full load can turn round much more quickly and with far less disturbance to its neighbours than a motor van with its far larger turning circle." The experience of other commercial firms testifies to this, and that for narrow streets and confined yard spaces the horse and horse transport is supreme.

Relative Cost.

The real determining factor, in whatever the form of transport employed, is one of cost. Cost is an embracive term and variable. It starts with the initial purchase prices of horse and horse wagon on the one hand or a motor vehicle on the other. These may be taken at £50 to £75 for a heavy draught horse, £40 to £50 for a van horse, £70 to £100 for a heavy horse vehicle, £70 to £80 for a light horse vehicle; £160 to £400 for a 25-cwt. motor lorry, and £500 to £800 for a 4-ton motor lorry.

Cost also includes, in the case of horse transport, drivers' and stablemen's wages and insurance, feeding and stabling charges, saddlery, grooming, veterinary attendance, shoeing, depreciation of horse (the average service being, say, eight years), depreciation of vehicle (the length of life being from 10 to 20 years), insurance, repairs, and the interest on capital outlay of horse vehicle and harness. In the case of motor transport, charges include wages and insurance of drivers and loaders, petrol (13 to 20 miles to the gallon for a light motor lorry, and 6 miles to the gallon for a heavy lorry), oils, repairs, garaging, cleaning, licence at £26 for a light lorry (25 cwt.) and £48 to £60 for a heavy lorry, insurance at 2 to 3½ per cent., depreciation at 15 per cent. (the average length of service being 6⅔ years) and interest on capital outlay at 5 per cent. The overhead expenses of interest on capital, licences, insurance, and depreciation are heavy in the case of motor vehicles; there is no tax on a horse drawn vehicle when the name of the owner is displayed on it. In addition to the above, maintenance and storage of spare vehicles, from an overhead charges point of view, is greater in the case of motor transport than with horse transport, and moreover, the latter can always work on the basis of a change of horses for individual vehicles; not so with mechanically-propelled vehicles.

Comparative Costings of Horse versus Motor Transport.

Two years ago very carefully compiled and detailed statements of comparative costings of horse *versus* motor transport were kindly supplied by 14 municipalities and 14 commercial firms in the Metropolis and in the Provinces under the headings of single horsed vehicles, pair horsed vehicles, 25-cwt. motor vehicles, and 4-ton motor lorries. The statements distinctly show that for the ordinary trade of cities and towns, *viz.*, in distributive trades, manufacturing trades, cartage of goods, and in the work of local authorities, the horse is much cheaper than the motor on a daily computation of work, and working within a radius of from four to six and sometimes eight miles.

The publishing firm previously mentioned state that "our records show that it is definitely cheaper to use a horse when a horse can do the work than it is to use a motor van," and it has been the firm's experience "that no car yet submitted to us can compete on a question of cost with a horse vehicle doing about 20 miles per day."

A leading London transport firm, on a basis of 20 miles per day, gives costings as follows:—

	Light horsed vehicle (One horse)	Heavy horsed vehicle (Two horses).	Motor Van (25 cwt.)	Heavy Lorry (4 tons).
	s. d.	s. d.	s. d.	s. d.
Cost per day of 8 working hours ...	17 9	25 7	24 2	36 6
Cost per hour ...	2 2½	3 2½	3 0¼	4 6½

A large London Stores computes its daily costings for 313 working days per year, and 8 hours per day at 19s. 6½d. for single light horse van, £1 8s. 10d. for a 25-cwt. motor van, £1 5s. 4½d. for a pair horse van, and £1 19s. 8d. for a 5-ton motor lorry.

The all-in costings of one of London's dairy companies with a large stud of cobs works out at 13 shillings and 9·38 pence per single horsed vehicle per day.

A co-operative business concern in the provinces with a stud of 400 horses and 80 motor cars for house to house delivery of commodities such as coal, milk, and bread, gave their costings per week as follows:—Single horse, £5 15s. 7½d.; 25-cwt. motor vehicle, £10s. 0s. 7·2d. (per week of 48 hours); pair horse vehicle, £5 18s. 7½d. per horse; 4-ton lorry £15 8s. 7·4d. (per week of 48 hours).

The costings attaching to a London municipality daily are estimated at 18s. 10d. for a single horsed vehicle, while those of a 4-ton lorry are estimated at £2 5s. 8d.

Liverpool Corporation, with a stud of 367 horses, and renowned for their economic handling, are able on a commercial basis to supply horses for street cleansing work, paving, sewers, etc., at the remarkably low figure of 1s. 1d. per horse per hour. As illustrative of the extended use of horse labour which this Corporation is making, it may be remarked that for the above work the supply of horses to the various works, expressed in terms of single horses, working an eight hour day basis, has gone up from 97,482 in 1928 to 99,654 in 1929. It will be remembered that a few years ago at Islington two horses of this Corporation pulled and controlled a load of 16 tons on a wagon weighing two-and-a-half tons.

The above figures sufficiently demonstrate that in commercial circles and in the common trade of the country, whether such relates to the smaller trader, the large carrying company, the retail business firm, the milk vendor, the City Corporation or the Municipality, the horse, properly used, is an indispensable factor, and that horse transport in its recognised sphere of utility, carries economic advantages over mechanised means of transport. Long distances by road, and heavy haulage are not the metier of the horse, and are best left to a mechanism which is calculated in multiples of horse power.

The details of costings, which, as has been remarked, are now two years old, have been verified by the National Horse Association, of 12 Hanover Square, London, W.1, and the Association has reason to believe that comparative costings as they stand to-day are even more favourable to the horse and horse transport than they were two years ago.

So much for the horse of commerce, and now for a few remarks on the horse of agriculture, the horse bred on the farm eventually becoming the commercial horse of the city and town.

Comparative Cost of Horse Labour versus Tractor in Agriculture.

It is significant of improvement in horse industry and a growing favour in the use of the horse, that under the

Horse Breeding Act, 1910, 22 more stallions were registered last year than in the previous year, and now number 1,089 heavy stallions, and 347 light stallions, or a total of 1,436. The number of heavy foals dropped during the year was 22,833, which is an increase on the previous year, and is encouraging. Young mares, too, show a marked improvement all round. The situation speaks well for the careful and sympathetic handling of the Heavy Horse Breeding scheme by the officials of the Ministry of Agriculture, the business-like administration of the Light Horse Breeding scheme by the War Office, and the care exercised by the various pony societies in preserving and improving our native breeds of useful ponies.

There need be no fear of serious displacement of the horse of agriculture by the tractor. To be of any real economic advantage a tractor would be required to displace at least two and a half pairs of horses, an impractical proceeding on the comparatively small farms of the country. Moreover, tractors are not adaptable to the varying circumstances and requirements of farm life and work, or in other words, are fair weather birds.

Mr. James Wyllie, of the Department of Economics, South-Eastern Agricultural College, Wye, Kent, conducted a very valuable series of investigations a few years ago on the comparative costings of horse labour and tractors, taking 16 farms for horse labour, with an average of five horses per farm, and seven farms employing nine tractors. A report of the investigations is published in pamphlet form, and may be obtained from the Secretary of the College, price 1s. Mr. Wyllie's conclusions were that, covering a period of three years, the average annual cost per tractor was £86 (the third year was £119 17s. 8d.), of which depreciation formed 34 per cent., repairs and renewals 23 per cent., petrol and oils 42 per cent., and sundries ½ per cent. The average cost per horse per annum was between £36 and £37. The average number of hours worked per tractor per annum was only 580, while the average number of hours worked per week for horses was about 33 hours. The average cost per tractor hour was 3s. as compared with 5d. per hour for horse labour.

It would seem, therefore, that tractors are chiefly maintained for times of pressure, when under favourable conditions work is required to be done rapidly; they are not within the province of the ordinary farmer, who, under the present depression of agriculture, has difficulty in making ends meet.

Malayan Veterinary Service Changes.

The Veterinary service of the Straits Settlements and Federated Malay States remained under the control of the Medical Department throughout 1929, says an official report, but a Principal Veterinary Officer was appointed in 1930, with headquarters in Singapore. The subordinate staff of Assistant Veterinary Surgeons and Veterinary Inspectors are fully qualified graduates of a recognised Indian Veterinary College, where they have to undergo a three years' course of training.

Army Veterinary Service.

London Gazette—War Office—Territorial Army.

Royal (Dick) Veterinary Coll. Contgt. O.T.C., Sen. Div. —Sec.-Lieut. A. P. Steele to be Lieut. (October 4th).

The Public Health Department—Meat Inspection.*

By Lieut.-Colonel T. Dunlop Young, O.B.E., M.R.C.V.S., D.V.S.M.

Veterinary Inspector and Chief Inspector of Meat, City of London.

The work of meat inspection as at present undertaken by local authorities in this country is conducted on what may be called the "detective principle," because the power to examine meat and other foods is given by the Public Health Acts, in which the words "a Medical Officer of Health or Sanitary Inspector *may* examine, etc.," are employed. It therefore follows that meat inspection, being optional, is lacking in uniformity, depending on whether the local authority and its officers regard such work as important or not.

In large cities and some urban districts meat inspection is regarded as of considerable importance, and there has of late years been a marked increase in the number of officers engaged in this work, especially in Public Abattoirs, but this is not so in many rural districts; indeed, it is only during the last few years that any reference to the destruction of diseased or unsound meat has appeared in the reports of Medical Officers.

This change has been due not so much to increased activity on the part of local authorities and their officers, but to the introduction of the Public Health (Meat) Regulations of 1924, which make it compulsory for butchers, or persons who intend to kill animals for sale for human consumption, to notify the local authority of the district in which the slaughterhouse is situated of intention to kill. In addition, if anything suspicious of disease in a carcass is observed, notification must also be given to the meat inspector or local authority and the carcass detained for inspection. The subsections are so important that they are given herewith.

Part II. (8) A person shall not slaughter any animal for sale for human consumption unless it has, not less than three hours before the time of slaughtering, delivered or caused to be delivered to the local authority notice of the day, time and place on and at which the slaughtering will take place; and (9) where on the slaughter of an animal for sale for human consumption it appears that any part of the carcass or internal organs is, or may be, diseased or unsound, the person by or on whose behalf the animal was slaughtered shall forthwith give notice of the fact to the local authority; and (10) the person by or on whose behalf an animal is slaughtered for sale for human consumption shall not cause or permit the carcass of the animal, including the mesentery and internal organs, other than the stomach, intestines and bladder, to be removed from the place of slaughter until such carcass with its organs has been inspected or its removal has been authorised by an inspector of the local authority.

Much difficulty exists in efficiently carrying out those Regulations, because of the number of private slaughterhouses, registered and licensed, still in existence throughout

* Reprinted from *Better Health*, the official Journal of the Central Council of Health Education of the Society of Medical Officers of Health, November, 1930.

England and Wales; the number is said to be about 20,000. In some of the rural districts the numbers vary very much, with only one inspector available, and this officer's duties may, and generally do, include that of Surveyor (road repairs, building construction), sanitary inspector (food and drugs and meat inspection work), etc. Obviously it must be impossible for one officer, no matter how anxious he may be to do his duty, to attend to the inspection of carcasses in all those slaughterhouses where killing may be conducted at all hours, day and night, seven days a week.

This is confirmed by the amount of diseased meat consigned from rural districts to cities, where it is detected and destroyed. On the facts being conveyed to the meat inspector of the district from which the diseased meat was received, that officer generally states: "I regret that it is impossible for me to find time to examine all the carcasses in my district at the time of slaughter. I should have assistance; the matter has been before my council, but due to the increase in expenditure involved an assistant cannot be appointed." There the matter rests. The butchers are also placed in a difficult position, because even when they notify they have a carcass which should be examined and no inspector arrives, such a carcass during hot weather may soon decompose and be entirely lost in complying with the Regulations, while if promptly examined it might have been passed by the inspector.

Meat inspectors in the cities are also placed in a difficult position, because they often find that carcasses from which parts have been cut are sent into their districts and no means exist of ascertaining at once whether the parts missing have been cut away by or under the supervision of the slaughterhouse inspector or by the butcher who consigned the carcass.

What is the remedy for this chaotic state of so-called meat inspection? Obviously, from an inspection and public health point of view, the only solution is to do away with private slaughterhouses and erect public abattoirs, appoint well-qualified meat inspectors and stamp all meat passed for human consumption. This could only be done in populous localities. New Zealand shows a good example of this method; there, as soon as the population of a district amounts to 2,000, the local authority must erect a public abattoir, private slaughterhouses must not be used and meat inspection is conducted by Government officers. Scotland also sets a good example. By its Public Health Act of 1892 public abattoirs must be provided and private slaughterhouses are forbidden.

Dr. Leighton, Chief Foods Inspector, has stated that about 90 per cent. of home-killed meat consumed in Scotland is from animals killed in public abattoirs. Figures lately presented in reply to a question in the House of Commons bear out this statement. They were approximately: animals killed in public abattoirs in Scotland—cattle 80 per cent., sheep 75 per cent., and pigs 84 per cent. It would be interesting if the figures for England and Wales could also be obtained.

There would, even if public abattoirs were erected in towns, still remain a large number of private slaughterhouses. To have those properly supervised the work might be entrusted to full or part-time veterinary officers who are at present engaged by local authorities to carry out duties under the Tuberculosis Order, the Milk and Dairies Acts and Diseases of Animals Acts.

Any carcasses and organs found to be unfit for human food could be saturated by some suitable disinfectant and reported to the District Medical Officer of Health or Sanitary Inspector to be dealt with under the Public Health Act, and a record kept to be entered in the Annual Report of the Medical Officer of Health.

If such a method were adopted two useful purposes would be served at a small cost to the ratepayers, *viz.*: A fairly satisfactory system of meat inspection, associated with stamping of passed carcasses, and an *ante-mortem* inspection of animals, whereby contagious diseases could be detected in their earliest stages and prompt measures taken to prevent their spread.

This system was suggested by the Departmental Committee on Meat Inspection in the following words: "In the rural and smaller urban districts it would be advantageous if the services of the county veterinary officers appointed for similar purposes to those in large towns could be utilised for the purpose, and we hope that the county councils whose officials already co-operate with those of the smaller local authorities in various other matters would be willing to facilitate such an arrangement where circumstances permit it."

The Minister of Health, in an address given to the 11th International Veterinary Congress on August 8th, urged closer co-operation between the Ministry of Agriculture and his Department in all matters relative to inspection and the eradication of animal diseases. Here appears to be one of the subjects in which his advice could be adopted. Unfortunately this logical recommendation of the Departmental Committee has not been adopted in England, although it is in operation in Scotland and Holland with much success.

At present more attention is being given to the hygienic handling and exposure for sale of meat. Prior to the issue of the Public Health (Meat) Regulations of 1924, meat was often exposed for sale and handled in an objectionable manner. It was common at one time to see meat placed on a piece of sacking at the public market awaiting transport by carriers to its destination. The Corporation of the City of London deserves credit for consistently urging for reform in handling food, and now the exposure of meat and method of handling it in the Smithfield Markets is highly commented on by visiting officials and the general public.

There are still butchers who consider that meat cannot be kept and sold in shops with closed windows. This opinion is refuted by those who have seen the method successfully adopted by butchers in London, provincial towns, Scotland and overseas cities, especially in Australia, where the climate is less suitable than that of London for keeping meat free from flies and contamination. Many up-to-date butchers have their meat kept under covered glass counters and cases; some have refrigerating pipes fixed under those cases so as to maintain the meat at a suitable temperature.

Within the last two years much attention has been given by progressive meat purveyors to what has been termed "Cartoned Meat," that is, meat cut up into small joints suitably trimmed, free from all surplus fats and bones, quickly frozen at very low temperature, and packed in transparent wrappers ready to be taken away by purchasers. The joints are kept in refrigerated cases such as those already described.

Clinical and Case Reports.

An Account of an Acute Outbreak of South African Horse Sickness (1928).

By Z. Morcos, M.V.Sc., F.R.C.V.S., D.V.H.
Professor of Bacteriology, Cairo Veterinary College.

In this outbreak, horses suffered most, mules least; a few uncertain cases were reported among donkeys, but being on the spot, Luxor, where most of the cases were, no donkeys at all were seen to suffer. Three suspected donkeys were put in quarantine in contact with badly affected horses for one month without any symptoms whatever.

Symptoms.—The following were the features of the disease as seen on the spot:—Incubation period four to five days, death in most horses affected took place within a week from the appearance of the symptoms; but mules to a certain extent resisted and some spontaneously recovered. Death rate in horses was about 90 per cent. (but later all affected horses were destroyed) early in July at the commencement of the disease. A continuous rise of temperature reaching 40° C. to 42° C., dropping suddenly before death.

On the second day of the rise of temperature, respiration was very rapid and shallow, 60 per minute; friction sounds were distinct; pulse was regular but weak and slow.

Together with the respiratory changes, *hyperæmia* of the tongue in patches which rapidly spread, and the tongue looked purple in colour. At this stage, œdema of the supra-orbital fossæ was evident (see chart and photos). Just on death, the animal undergoes a most severe course of pain, a combination of acute lung, gastric and kidney troubles.

Post-mortem.—The pyloric end of the stomach highly inflamed; red hepatisation of the lungs; pericarditis and pericardial exudate tinged with blood; kidneys inflamed; albumen was detected in the urine of the affected animals: these, together with the tongue discoloration and supra-orbital œdema, were most diagnostic (see lung and kidney sections).

Experiment 1: (*a*) five guinea-pigs were inoculated intraperitoneally; each received ½ c.c. from the heart blood of five different horses. The blood was collected aseptically a few minutes after death of horses.

(*b*) Five rabbits were inoculated intraperitoneally; each received 1 c.c. of aseptically-drawn blood from five horses just after death.

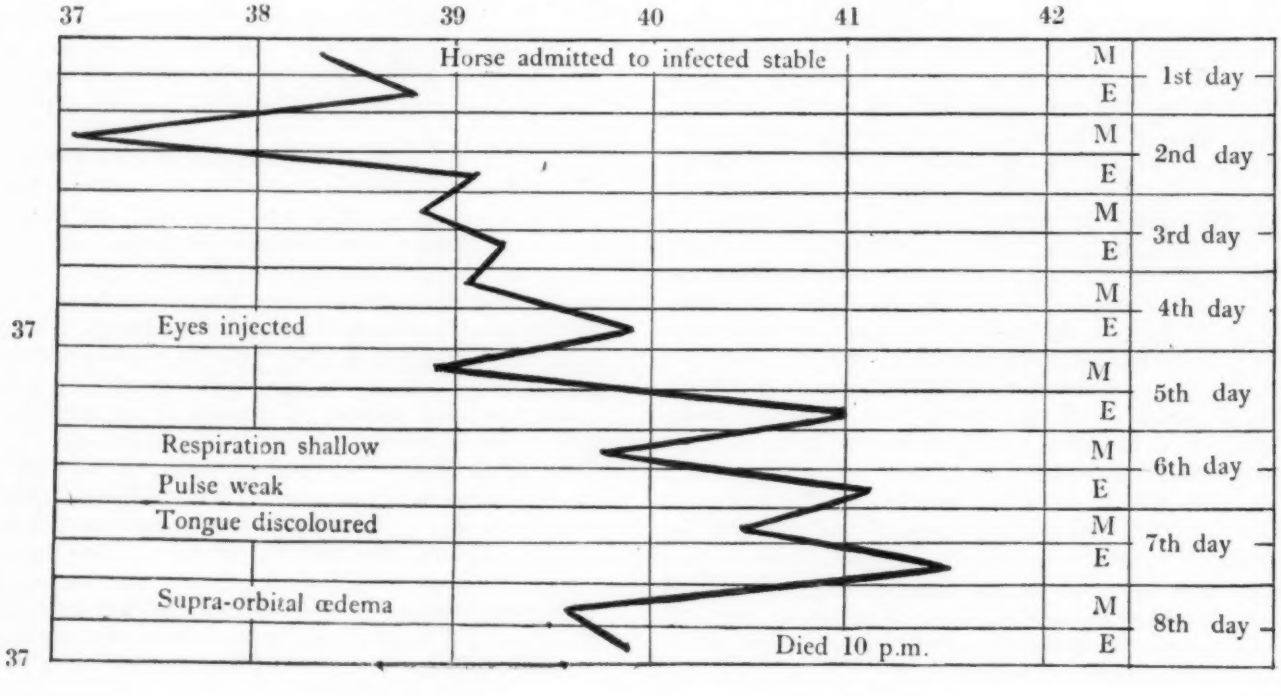
Both rabbits and guinea-pigs were kept under observation for three weeks and none showed any deviation from normal.

(*c*) Blood and pericardial fluid were aseptically drawn from seven different animals immediately after death and culture tubes were seeded and incubated aerobically and anaerobically for ten days, with negative result.

Experiment 2: Method of transmission and a possible method of protection: a stable situated near a pond, where mosquitoes were abundant and where six horses died with the disease, was used.

Three horses from a far *non-infected* district were admitted into the stable:—

Temperature Chart—South African Horse Sickness.



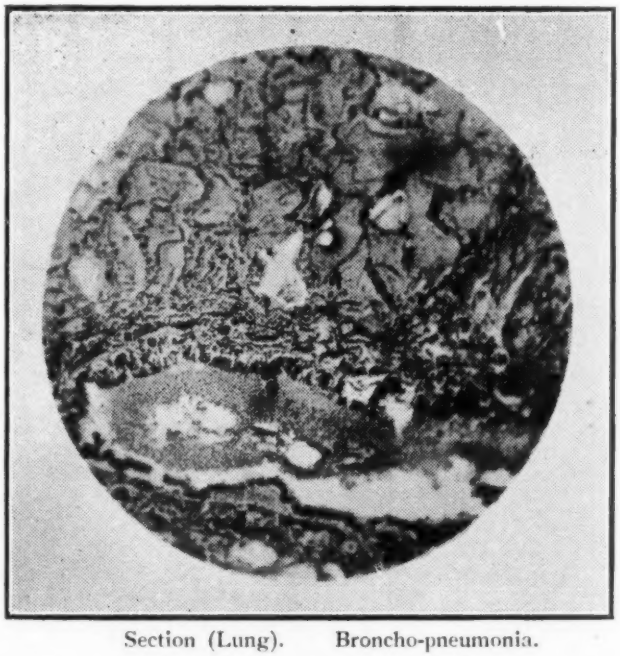
This method of keeping and handling meat, though not approved of by many retail traders, is not only more economical, due to the better utilisation of unrequired fats and bones and lower cost in transportation, but is a distinct advance in the hygienic handling and exposure for sale of perishable food.

Compared with the pre-war period there is throughout England a considerable improvement in the inspection of meat in our cities, but, as pointed out, much requires to be done in rural areas. This can only be affected by Medical Officers of Health urging that the necessary steps be adopted.

South African Horse Sickness.

Taken ten days after the appearance of symptoms. Tip of tongue discoloured, but œdema subsiding. The animal recovered.

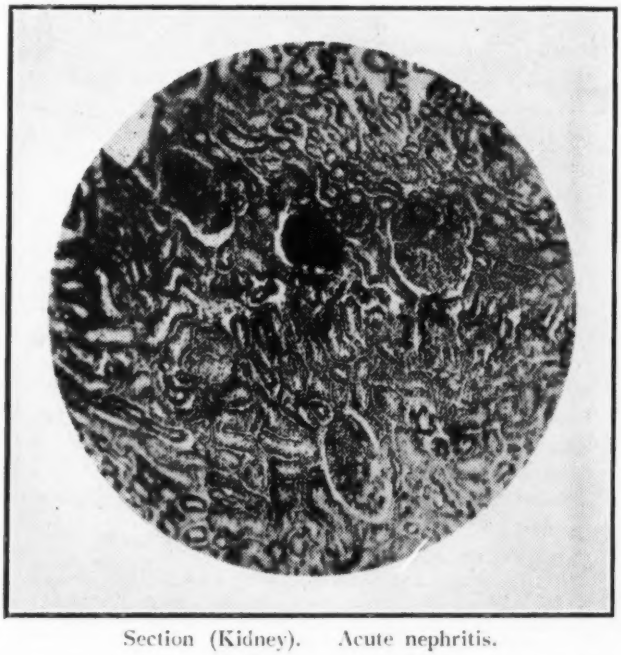
Taken 24 hours before death. Œdema of head, most marked at supra-orbital fossa. Patchy discoloration of tongue.



Section (Lung). Broncho-pneumonia.

Horse 1 was well smeared daily along the back, poll, neck, perineum and legs with a mixture of equal parts of paraffin and crude oil. This treatment was started before admission into the stable.

Horse 2 was treated the same way as Horse No. 1.



Section (Kidney). Acute nephritis.

Horse 3 was admitted to the stable without any treatment.

Result: Horse No. 3 died with the disease on the eighth day of admission, while horses Nos. 1 and 2 *escaped,* and were put in isolation till police movement orders were cancelled.

An Organism Simulating the Preisz-Nocard Bacillus.

By Z. Morcos, M.V.Sc., F.R.C.V.S., D.V.H.
Professor of Bacteriology, Cairo Veterinary College.

Case 1.

Dark Bay mule—obstinate healing wound, oval, 1½-in. by 1-in., situated under the right superior maxillary ridge. Soft intact nodules, ½-inch in diameter, were seen along the sides of the abdominal wall. Mallein test negative.

Case 2.

Cross-bred mare (see photos) eight years old, angry looking suppurating ulcers around off hind fetlock; smaller drying up ulcers at the inner sides of the thigh. Mallein test negative.

Case 3.

Grey Arab horse, large, irregular, obstinate healing wound, at the inferior surface of the girth region. Mallein test negative.

Case 4.

Red aged Italian-bred mule. Various irregular, granulating ulcers between the fore limbs. Mallein test negative.

Case 5.

A thoroughbred Bay horse, multiple, round ulcers, ½-in. by 1 in., at different parts of the body, along the neck, thigh, round the eyes. Mallein test negative.

Case 6.

Cross-bred grey horse, irregular, multiple, ulcers all over the body. Mallein test negative.

Microscopic and Cultural Findings.

Blood films of the six cases were negative to protozoa. Pus films of all the cases revealed Gram positive cocci, Gram negative cocci, Gram positive streptococci and Gram positive, short, plump bacilli.

Organisms Isolated from Ulcers of the Six Cases.

Organism No. 1.—Gram positive, short, plump bacilli, 2-3 microns long by 0·3-0·5 microns wide, non-motile, non-sporulating ærobic. Growth took place on all ordinary media, best on glycerine media. *On solid media,* 48 hours after incubation, very small, isolated, colourless, almost the same as streptococci, colonies were seen; on the fourth and fifth days of incubation the colonies became bigger, raised, and greyish; on subsequent subcultivation, luxuriant white dry growth was seen.

On liquid media, the growth appeared after three days of incubation as a thin, oily film, floating on the surface; later on, the 5th and 7th day of incubation, the film became white, thicker and granular, granules sedimented and a fresh top layer appeared.

Dextrin and lactose were not fermented, but glucose was fermented.

Pathogenicity of Organism No. 1:

White Rats.—Three-days-old glycerine broth cultures were used. 0·25 c.c. was inoculated subcutaneously at the inner side of the thigh; seat became red, hot, swollen; it ruptured and an ulcer formed after ten days of inoculation, healed up spontaneously after one month. The organism was recovered from the ulcer.

Guinea-pigs.

0·5 c.c. was inoculated subcutaneously into the inner side of the thigh; an ulcer formed on the 8th and sometimes on the 10th or 12th day of inoculation (see photo) healed up spontaneously 30 or 40 days after inoculation.

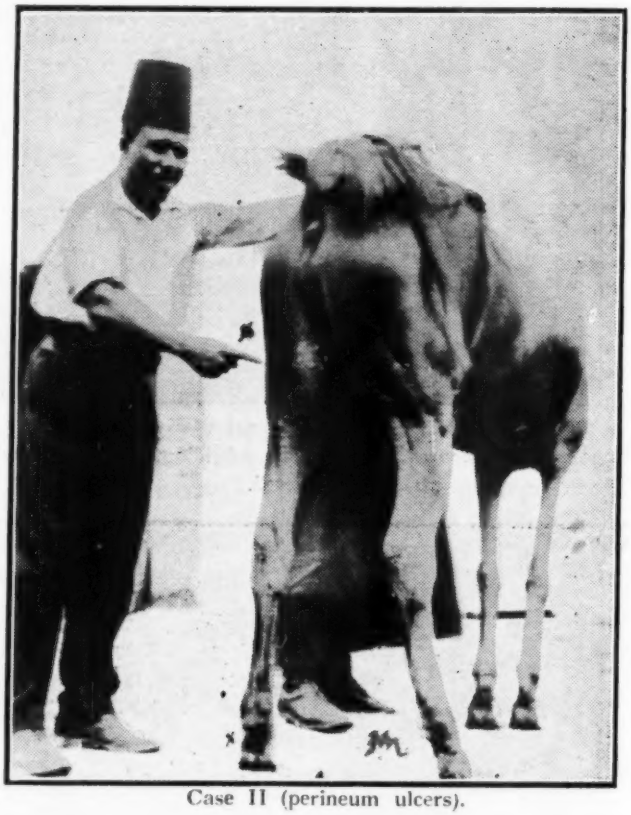
0·25 c.c., three-days-old glycerine broth culture inoculated intraperitoneally, resulted in non-adhesive suppurative orchitis six or eight days after inoculation (see photo).

The organism was recovered from the testicle; on *post-mortem,* 20 days later, in three cases secondary foci were seen in the internal organs of the intraperitoneally inoculated guinea-pigs.

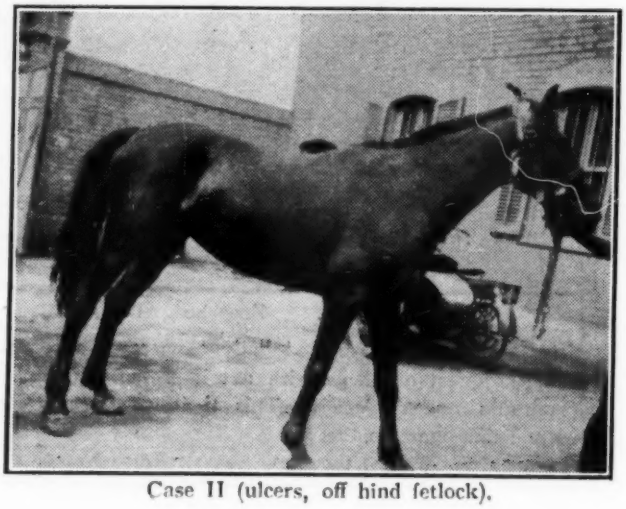
This organism was isolated from all the six cases and it simulates the Preisz-Nocard bacillus.

Organism No. 2.

Gram positive, slowly hæmolytic streptococcus, non-pathogenic to white rats. It was isolated from the first *three* cases only.



Case II (perineum ulcers).



Case II (ulcers, off hind fetlock).

Organism No. 3.

Staphylococcus aureus, isolated from the last *four* cases only.

Organism No. 4.

Staphylococcus albus, isolated from all the six cases.

Treatment Attempted.

Preparation of Vaccine.

Five-days-old culture on broth of the organism simulating the Preisz-Nocard bacillus was added to three-days'-old cultures on broth of the isolated streptococcus and *Staphylococcus aureus* in the following quantities by volume :— Bacilli ... ... 3 parts
Streptococci ... ... 1 part
Staphylococci ... ... 1 part

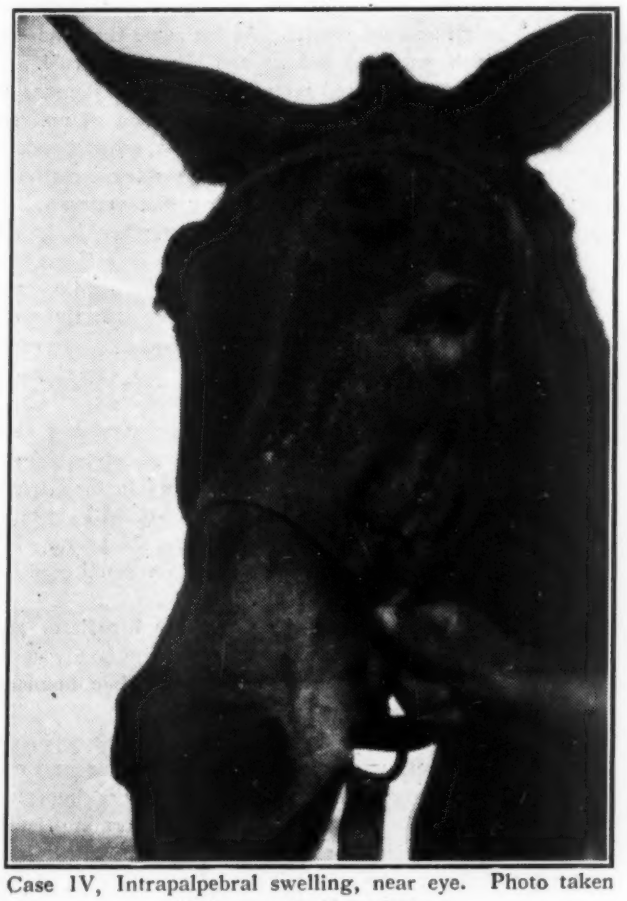
The mixture broth culture was killed by the action of 5 per cent. ether for two days at room temperature, incubated over night to get rid of the ether, vaccine seeded on culture media (control) for viable organisms, with negative result.

Doses, 2 c.c., doubled weekly and injected subcutaneously.

The first three cases were tried for three months, but the vaccine neither improved the already-formed ulcers nor stopped fresh ulcer formation.

Local applications of iodine ointment and actual cautery were useful, but case 5 and case 6 were treated by cutting and curetting and both did well and were discharged two months after admission ; but it remains to be seen whether or not fresh ulcers will appear in time.

Guinea-pig, ulcers, right thigh, 8 days after subcutaneous inoculation of the isolated bacilli.



Case IV, Intrapalpebral swelling, near eye. Photo taken 12 hours after inoculation.

Guinea-pig, orchitis, 7 days after intraperitoneal inoculation of the isolated bacilli.

Testing Animals with the Dead Culture of the Bacillus Preisz-Nocard.

Five-days-old glycerine broth cultures of the bacilli were killed by 5 per cent. ether; and cultures were made after driving out the ether to ensure sterility of the preparation.

Mule No. 4 was inoculated intrapalpebrally with 2·5 c.c., and a healthy grey horse (control) was inoculated intrapalpebrally, too, with the same dose as the mule.

Both animals developed a swelling at the seat of inoculation without any discharge; the swelling disappeared in the *control* six hours after inoculation, but the swelling of the eye of the mule disappeared 18 hours after inoculation (see photo).

Summary.

A bacillus simulating the Preisz-Nocard bacillus was isolated from equine skin ulcers.

A vaccine prepared from the bacillus in question and the ulcer-associating bacteria, was found useless in the few cases attempted.

Animals with skin ulcers when negative to Mallein, may be tested with a culture of Preisz-Nocard bacillus prepared as in new tuberculin mallein for diagnosis.

Tuberculous Milk Menace.

Addressing the Leeds Luncheon Club recently, Sir Robert Jones, the eminent Liverpool surgeon, said that more than half the cases of tuberculosis of the joints were due to direct poisoning of milk by the bovine type of tubercle bacillus, and the rest were due to infection by the human bacillus from direct or indirect contact of the child with a consumptive adult. If we could free our children from this contact and feed them on pure milk, the problem would be practically solved.

Thirty per cent. of cows suffered from tuberculosis. One out of twelve specimens of milk introduced into our cities contained living tubercle bacilli. To free the nation from this danger involved the slaughter of cattle, the sanitary disinfection of all cow houses, the washing of the tails and udders, the milking in byres exposed to sunlight and air and supplied with running water. There should be repeated tests and the investigations should be carried out by independent official inspectors.

The iniquity was that dirty cows in a dirty byre were often milked by men with dirty hands. Often the debris of tubercle appeared first when a man started milking, and this was merely thrown carelessly aside and the man continued milking without even washing his hands after contact with the bacillus. Men took interest in the cigars they smoked and the champagne they drank; if they did not take the trouble to find out whether the milk they took was poison or not they were taking a very serious responsiblity.

Dr. T. N. V. Potts (Medical Officer of Health for the West Riding) pointed out that, though Yorkshire might not compare very favourably with Lancashire in the provision of beds for cripples, the West Riding was tackling one section of the problem very thoroughly. It was going to the root of the evil by a system of close inspection of cattle in the Riding through its veterinary surgeons.

It is now estimated by the President of the Board of Education that 500,000, or nine per cent., of the elementary school population of England and Wales, are receiving a daily supply of milk, as compared with 400,000 six months ago.

Eleventh International Veterinary Congress, London.

August, 1930.

Abridged Papers.

(*Continued from page* 16.)

Observations of the Accepted Theory of Heredity in Relation to Animal Husbandry.

By Professor Dr. Karl Keller.
Director of the Department of Husbandry and Obstetrics, Veterinary High School, Vienna.

Twenty-eight years ago experimental research in heredity received a real impetus through the rediscovery of the Mendelian laws and was extended by the favourable influence of biometrical methods and progress in cytology.

Mendel's laws, discovered in plants, were first turned to practical profit in plant cultivation, and were not applied to animal husbandry till much later. It was found that their application to animals was much more difficult, especially when carried out in connection with practical husbandry rather than in a scientific institution. Our horizon has widened during the last 20 years, but very gradually.

The animal breeder works under conditions different from those of the horticulturalist and cannot expect the same simple, straightforward results. At the same time, he can indicate which paths to follow, and which to avoid.

Mendelism has shattered certain aspects and dogmas of breeding, such as the ideas of "blood" and of uniform distribution of hereditary values. On the other hand, it has established the correctness of older empirical methods, such as inbreeding and other breeding discoveries.

The animal breeder and heredity researcher is handicapped, since his subjects are not capable of self-fertilisation. Two beings must always be used for propagation and if the character of at least one is not known then the problem is similar to an equation with two unknowns. In order to carry out the genotypical analysis of an experimental animal several crossing experiments are necessary. Further disadvantages are low fecundity, long gestation and slow growth of the young. For instance, to investigate a certain bull and a certain cow with regard to their transmission of milk yield through the breeding of an F_2 generation of only four cows will take at least 14 years. For most of our knowledge we must rely on small, quickly multiplying mammals or on birds.

Another difficulty is that the path from hereditary predisposition in the germ-plasm to the complete bodily entity is more complicated in the higher animals than in plants and lower animals. We must consider such Mendelian hypotheses as Homomery and Polymery, and the complicated influence of constituents and organs on permanent racial and working characteristics, and also the very important rôle played by the endocrine glands in forming bodily attributes. Habits, constitution and environment may therefore influence the transmission of morphology, physiology, sex and milk yield.

The exact determination of the variability of the characteristics in question is often difficult and circumstantial. Quantitive differentiation depends in its development on the age and conditions of life of the animal. But without such influences one meets passing transitions in the phenotype which lead to more or less voluntary classifications. In the breeding of a race of cattle with white muzzles, calves with blue muzzles often appear. The reason here is that the breeders fail to notice the slight pigmentation at the edge of the muzzle.

It so happens that mistakes occur in books on breeding, *e.g.*, faulty views on the colour of horses. If such data are used they may lead to false conclusions, since our books offer few foundations for studies in heredity, and need reform.

Finally, performance tests must be considered. These have often been made with good results, although for an exact genetic analysis data hitherto obtained do not suffice, especially with regard to bloodstock, where the inferior animal often beats his betters.

Our knowledge of breeding must go deeper. Modern knowledge gives us concrete ideas on "inner reasons" which represent the criterion in definition of hereditary opinions and which deepen the division between transmissible and non-transmissible characters. Predisposition rather than actual characters are transmitted. Since comprehension of body variation, decided by environment and mutation, depending on germ-plasm modifications, enters more into practical breeding, so has a grasp of Phenotype and Genotype become the skeleton of basal breeding aspects. The problem of "inherited characters" has lost significance and even if the theory of factors, specially that of continuity of germ plasm and inability to influence it through the body has not yet lapsed, yet a firmer ground is offered to the breeder than that relying on the views of Lamarck. Precocity, for instance, is successfully obtained as the result of careful selection and not of good feeding only. Breeding demands thoroughness and care in selection and the discontinuance of excessive care and over feeding. In the breeding of domestic animals mutations probably occur, though whether through changes in the germ plasm, or through cleavages in virtue of particular factor combinations in the Mendelian sense is of less importance than the fact that they can be utilised in breeding.

"Breed" cannot be adequately described according to fixed principles of division. Since nearly all breeds of domestic animals are descended from different crosses, it is evident that within the breed wide differences may occur in inherited structure. In these breeds descendants are not of pure blood, but may show improvement or deterioration. Genotypical purity is not raised unconditionally throughout the duration of pure breeding. The desired homozygosity can sometimes be obtained very quickly—with good luck in the next generation—specially if only a few separate characters are considered. Since it appears in only a few animals, it can easily be lost in further generations. With regard to genotypical polymorphism it is clear, with the help of factor theories, that even in pure breeds undesired throw-backs may occur through the division of recessive characters or through fresh factor combinations. Such an heirloom may pass through many generations before it becomes obviously phenotypical.

With regard to our conception of Individual Potency, our ideas of dominance, homozygosity, polymery and factor coupling enable us to approach it, but modern theories of heredity have done little to clear up our comprehension of constitution, which now has many aspects. The word Constitution should be replaced by Health, Resistance Capacity or Habitus, in order to prevent misunderstandings.

The basic rules of Mendelism are of value to the practical breeder. Mere knowledge as to whether a character is dominant or recessive is valuable. If one of the parents possesses a dominant character, then at least half the descendents will possess it, and in the case of homozygosity of one parent, all of them. A sire which possesses the desired attribute homozygously can beget progeny of satisfactory quality out of different dams. The dominant character can easily be eliminated from a breed by removing its carriers. On the other hand, it is difficult to produce a strain in which the dominant character is homozygous. In particular, in complete dominance the phenotype gives no indication for selection and, according to the rule, two mistakes will occur for each success. At best, genotypical uniformity can be attained by inbreeding, *i.e.*, if one can cross to a homozygous animal.

Conditions are very different when recessive characters are considered. Pure breeding is easy, since the phenotype is also the genotype. Elimination of the recessive character, however, demands very thorough measures, and entails bad mistakes in practice. One must remove not only the possessor of the character, but also both parents and all their offspring. It is conceivable that breeders, on the score of economy, will object to this process, which should, however, be insisted on.

In this connection the theory of Lethal Factors has assumed great importance. They count in a mathematical sense as negative factors. Scientific examination of certain objects, specially of the classical Drosophila, has disclosed a series of such factors. In the domestic animals we have bulldog calves, cleft palate in dogs, sterility of albino horses. It follows that there are forms of sterility of blastogenous origin and the fertilised ovum or very young embryo dies from internal causes which are therapeutically inaccessible. In pigs sterility may arise from lethal factors, since here we frequently find small mummified embryos next to properly formed fœtuses in the uterus. In the dog, absence of conception or occurrence of abortion helps the assumption of such factors, since these phenomena are seen in animals with partial albinism, often associated with degenerative characters.

Lethal factors are also important in diseases of the young. We see newly-born foals and pigs which show a definite lack of vitality not to be explained by infection, though they are most susceptible to external influences. This condition is certainly hereditary in domestic animals. The horse breeder must eliminate his known "unlucky mares." Similarly in the pig one should not aim so much at large litters as at health and resistance to disease in the young pigs.

Polymery plays an important part in breeding and gives us the key to the luxuriance of the hybrid, which occurs when two animals of different breeds are mated, both being endowed with different kinds of equable intensifying factors, which combine in the hybrid.

The importance of inbreeding has been touched upon and incestuous breeding must also be considered. Recent studies in inbreeding have, with the help of Mendelism, made clear its outstanding successes and also its so-called disadvantages. There are no overwhelming grounds for the practice.

The most important principles of practical animal breeding are as follows:—

1.—Pedigree gives no reliable information as to the genotypical constitution of an animal. The phenotypical constitution of the brothers and sisters of an animal can sometimes give a better insight into its genotype than that of its ancestors. The progeny alone, however, best decides the value for breeding. Help may be afforded by organisation and by improvement of equipment and maintenance.

2.—Excessive care and over-feeding of young animals make selection for breeding difficult. Favourable variations caused in that way have no hereditary value, but give a false impression.

3.—Physiological characteristics of importance, such as milk yield, flesh production and fertility can only reach a valuable stage quickly and permanently if no special attention is paid to other characteristics, such as colour and build.

4.—Inbreeding is the best method of securing breeding for production. Crossing back to a known valuable sire is likely to produce a relatively large number of animals with homozygosity in many factors. So-called inbreeding disabilities probably arise from the sire, when the condition soon becomes diagnostic.

5.—Crossing between different breeds is valuable in several directions, such as the possible establishment of the dominant characters of one breed, the combining of desired characters of both breeds or the production of luxuriance. Further breeding with hybrids leads to varied cleavages and should not be encouraged.

6.—Undesired recessive characters can be eliminated only by removing their possessors together with the parents of these animals and any other progeny of the parents. Where this is not possible economically, inbreeding must be avoided and animals from unaffected families must be used for breeding.

7.—The carrying out of breeding experiments and the raising of animals with valuable hereditary factors is difficult with some breeds of domestic creatures such as pigs and fowls. With all breeds it is sometimes necessary to intensify ordinary breeding with male regenerators, produced in the larger breeding establishments.

8.—In the control of sterility and diseases of the young, one must have regard to hereditary factors. Elimination of animals difficult to fertilise, and selection for fertility and natural resistance may lead to permanent results, while too energetic therapy may, under certain conditions, encourage counter-selection.

H. H.

In his annual report for 1929, Dr. William Bullough, Medical Officer of Health, Essex, states that the clean milk competition was limited to farms which had never previously received an award, the aim being to extend a valuable educative influence.

Genetics Applied to Animal Husbandry.

By Professor Dr. A. Pirocchi,
Directeur de la Station expérimentale de Zootechnie annexée à l'Institut royal supérieur agricole de Milan (Italie).

For the following reasons Mendelian laws cannot be applied on a large scale in the field of zootechny, and the views regarding heredity held by the Neo-Mendelians cannot be accepted without reserve.

(1) Practically all the races of domesticated animals are of hybrid origin.

Purity of race, prior to making crosses, could probably be determined, provided it concerned only simple morphological characters in small, very prolific animals. But almost insurmountable difficulties are encountered in the case of large animals of limited fecundity when quantitative physiological characters are concerned (production of milk, meat, etc.).

(2) Auto-fecundation of the products F_1, F_2 . . . is replaced in domesticated animals by amphimixing. Hence the difficulty of recognising the individuals DD and DR which present the same phenotype. Theoretically, one could overcome this difficulty by analysing the genetics of descent. But for certain reasons which hinder the determination of the purity of race, this is not a simple matter in the case of large animals.

(3) One of the greatest obstacles is the small number of progeny produced by the domesticated animals annually. When only small numbers of animals are available for study, the Mendelian numerical ratios are rarely encountered, and it may even happen that all the progeny have the dominant character, or—although very rarely—the recessive.

(4) Large numbers of animals must be available to provide individuals presenting constant combinations of various characters. Research has shown that the ratio of pure animals to the total number under experiment is 1 : 16 for the combination of two characters, 1 : 64 for three characters, 1 : 256 for four characters, 1 : 1,048,576 for ten characters, and 1 : 1 trillion for 20 characters.

(5) The length of the biological cycle of the domesticated animals increases the difficulties. It would require sometimes more than a century to determine the purity of animals for crossing and to analyse the genetic descent of uniparous animals of limited fecundity with a long period of gestation.

(6) The definition and identification of characters, and particularly those which are of zoo-economic interest (weight, milk production, etc.), is a matter of difficulty. Since they are complex and always co-related to other characters, their independence cannot always be proved.

(7) The factorial conception has increased the difficulty of applying the Mendelian theory to animals. "Character" and "factor" are mere words, not explanations. We are far from having reached a plausible interpretation of things by supposing the existence of factors and . . . factors modifying other factors.

(8) The Neo-Mendelians localise the hereditary characters in the chromosomes. As the cytoplasmic heredity of Correns and the presence of group-specific substances in the red corpuscles of man, in the majority of fixed tissue

The Veterinarian and the Farmer.

Correcting a False Impression.

In the course of an address entitled "How I can save you £100 per annum" given by Mr. J. C. Leslie, Principal of the East Anglian Institute of Agriculture, Chelmsford, at a meeting recently held at Braintree under the auspices of the Local Branch of the Essex County Farmers' Union, Mr. Leslie is alleged by the *Essex Weekly News*, of December 5th, 1930, to have said that:—

> "A great deal of money was thrown away by farmers on veterinary surgeons' fees. The greatest enemy we have is the veterinary surgeon."

Upon exception being taken to this alleged statement, the subjoined letter was published in the *Essex Weekly News* of December 12th, 1930.

Sir,—In fairness to veterinary surgeons there is due an explanation of the reference to them in a report of an address which I gave at Braintree.

"The statement appearing by itself seems to be an attack on the veterinary profession. If you will be good enough, I should like you to give the context of this part of my address which I hope will explain any doubts which may exist on this point.

"I made no reference to diseases of animals, but only to disorders such as indigestion which often follow failure to control the total amount of dry matter fed to cattle.

"The agricultural adviser has great difficulty in getting feeders to exercise this control, and the ease with which they can get help from the veterinary profession to correct the results of uncontrolled feeding makes it still more difficult for the adviser.

"The word 'enemy' was used in the best sense of the word, and it was not suggested that the veterinary surgeon was an enemy of the farmer, but of the agricultural adviser, and only then from the point of view given above.

"The feeder knows very well that if his stock suffer from any ill-effects from overfeeding the veterinary surgeon will soon put them right for him. If the services of the veterinary surgeon were more difficult to obtain the feeder would then take more notice of the agricultural adviser's recommendations to control the bulk of the ration.

"It has always been the policy of the Institute of Agriculture to render all the service it could to the veterinary surgeons in the county, and in the future it hopes to be of even greater service."

I am, Sir,
Yours faithfully,
J. C. Leslie.

East Anglian Institute of Agriculture,
Chelmsford.
December 10th.

The Association's reply, which was published in the December 19th issue of the same newspaper, stated:—

"In reference to Mr. J. C. Leslie's letter in your issue of December 12th and to the report of the address he gave at Braintree published in your previous issue, I fear that Mr. Leslie's reference to veterinary surgeons may convey to your readers an impression that members of the veterinary profession are not fitted to give advice on the correct feeding of farm animals. I therefore wish to point out that this important subject forms a prominent feature of the work of the veterinarian of the present day, and that, having undergone a sound training in botany, chemistry, physiology and dietetics he is just as capable as is an agricultural adviser of giving advice on all matters relating to the feeding of farm stock. Moreover, the Veterinary profession in this and other countries claims a considerable number of members who have gained eminence for their knowledge and research work in this branch of Veterinary Science.

"Mr. Leslie does the veterinary profession an injustice when he suggests that the Veterinary Surgeon is the 'enemy' of the agricultural adviser, and this merely because his services are easily obtainable. Instead of the veterinary surgeon being the enemy of the agricultural adviser he should be his best friend. The veterinary surgeon and the agricultural adviser can do much by co-operation to help the farmer, but the veterinary profession cannot concede to agricultural advisers any superior knowledge or skill in the field of animal dietetics."

Yours faithfully,
F. Knight, *General Secretary.*

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cells, and in the spermatozoa proves, the cytoplasm must also be taken into account. Further, the conditions under which development takes place must also be considered, as has been proved by the study of the sexuality of bactracians.

(9) Their etiology does not explain mutations which appear suddenly and promptly become hereditary. Their appearance makes the application of the Mendelian theory extremely difficult.

(10) The functional exercise of the various organs, to which animals have to be subjected in order that they may be utilised to the utmost, forms another obstacle to the exact interpretation of experiments in genetics—that is to say, it is impossible to distinguish between the parts played by functional development and heredity in the results produced.

. . . . .

While recognising that, thanks to the investigations of the Mendelians and Neo-Mendelians, many problems of the physiology of descent appear to be less obscure than formerly, much research must be carried out in the vast field of biology before it is possible to arrive at data which are of practical significance.

The Shire Horse Show.

The Shire Horse Society, established to promote the old English breed of cart horses, will hold its fifty-second show on February 24th and the two following days. The society, of which His Majesty the King is Patron, and Mr. David Davies President, has just issued its list of prizes, the money value of which is about £2,000, in addition to the King's Champion Challenge Cup for the best stallion in the show, the society's challenge cup, presented by Sir Gomer Berry, for the best mare or filly, Mrs. Stanton's Perpetual Challenge Cup for the best gelding, and a number of other cups and medals. At the show last February there was a fine list of entries, though they were not quite so numerous as in 1929, when a special effort was made in connection with the jubilee year of the show, and the society may look forward again to another representative and successful exhibition of the breed which they have done so much to encourage and preserve from extinction.—*The Times.*

That malaria still cost the British Empire £52,000,000 annually, and killed in India alone, some 1,250,000 people a year, were facts mentioned by Sir Humphrey Rolleston last month at a meeting of the Wellcome Historical Museum. He described the discovery of cinchona bark and the subsequent isolation of quinine as of enormous importance in the preservation of human life and health, especially to the British Empire with its vast tropical possessions. It was not yet known how quinine acted; there were objections to the obvious view that it directly destroyed the malaria parasite. Some physicians thought it produced anti-bodies in the blood or a metabolite in the tissues; others, that it formed a film on the red corpuscles and so prevented the entry of the parasite.—*Journ. Inst. Hyg.*

Reviews.

Annual Report of the Salford Medical Officer of Health (Veterinary Section).

The Annual Report of the Medical Officer of Health for the City of Salford has been issued and contains a section by A. Alexander, Esq., M.R.C.V.S., D.V.S.M., Veterinary Inspector. This section deals with the work under the Diseases of Animals Acts, the milk supply and inspection of dairies, also the inspection of meat, slaughterhouses and of the offensive trades premises connected with the meat supplies.

The Report shows that, during the year, veterinary inspection of all animals exposed in the Salford Market was carried out. In the Fat and Store Market there were 62,464 fat cattle exposed for sale, of which 26,188 were Irish; and 4,163 dairy cattle were exposed, of which 3,998 were Irish. Altogether there were 344,976 sheep sold in the Market, of which 11,599 were Irish.

In connection with the Disinfection of Vehicles Order, the motor vehicles used for the transport of animals to and from the markets are cleansed and disinfected on the market premises under the supervision of the inspectors.

In addition to the lairs adjoining Salford Market there are also private lairs in connection with the Manchester Abattoir, which is in the area of another Local Authority.

Among the large number of old milking cows exposed for sale at Salford Market, the Veterinary Inspectors find, on *post-mortem* examination, that a large percentage of them are affected with tuberculosis although when exposed in the market alive they do not come within the scope of the Order.

It is an indication of the reduction of foot-and-mouth disease in the country, that they had no outbreak during the year 1929 at their Market, as Salford for many years has been closed at some time or another during each year, owing to outbreaks of foot-and-mouth disease either in the Market or its vicinity.

In the section dealing with the milk supply of Salford, it is stated that there are 693 registered retail purveyors of milk, and of these 222 sell bottled milk only. This is a comparatively high percentage of bottled milk and is a good example of the advantages of regular inspection in connection with the milk supply.

The Report states that special attention is given to the inspection of those farms which supply milk to the local Institutions.

Detection of Tuberculosis in Milk.

The following table gives the percentage of tuberculous milk detected during the year:—

	Percentage during the period 1921-1924.	Percentage during the period 1925-1928.	Percentage in 1929.
Milk from Cheshire ...	11·6 ...	10·3 ...	10·8
Milk from Lancashire...	4·36 ...	4·7 ...	9·4
Milk received in the City from all sources ...	7·27 ...	8·0 ...	9·71

(Paragraph from Report): "It will be seen that instead of any improvement, as might have been expected, the position with regard to tubercle bacilli in the milk has gradually become worse."

The Report further states that, in the two counties supplying milk to the city, there is no regular routine inspection of the herds. It is a very serious position that, in a county where over nine per cent. of the milk is found to be tuberculous, there is no regular inspection of the herds, and it would indicate that either the Tuberculosis Order is not being carried out, or, if it is being carried out, it has no effect in the reduction of tuberculosis bacilli in the milk.

The whole of the Report, including that on the Inspection of Meat—which shows that tuberculosis is responsible for more diseased meat than any other condition—is a very valuable one, and Mr. Alexander is to be congratulated upon its production.

B. D.

Agricultural Journal of Fiji.

The *Agricultural Journal*, issued by the Department of Agriculture, Fiji, Volume 3, 1930, contains *inter alia* a note by Mr. H. M. Stuchbery, B.V.SC. (Melbourne), one of the Government Veterinary Officers, regarding the report on Pigs and Pig Products, published as the Twelfth Report of the Imperial Economic Committee, and the application of this to Fijian conditions.

Mr. Stuchbery records that, contrary to common opinion in the tropics, the white breeds of pigs thrive well in Fiji if provided with suitable shelter from the sun. The coloured breeds, Tamworth and Berkshire, do very well in that Colony.

A plentiful and cheap food supply is available. In addition to maize and dairy by-products, rice-bran, coconut meal, bananas, etc., are to be had.

The writer stresses the need for associating pig-raising with dairying to their mutual advantage.

Suitable housing is most important, together with effective draining, as a means of controlling *Stephanurus dentatus*, the kidney worm.

The local market in Fiji for pig-meats is at present limited to the town, but is capable of expansion into the country districts. There is no reason why this industry should not be developed by those possessing sufficient skill in pig-husbandry.

. . . . .

The same number of the Journal contains the Rules approved by the Government of Fiji to govern the payment of subsidies on imported pedigree cattle and horses, and on good grade cattle. The former are eligible for a subsidy of £10 per head, the latter one of £5.

Grade cattle must be the progeny of a registered pedigree sire and a dam credited by a Herd Testing Association with producing in one lactating period at least 250 lbs. of butter fat as a two-year-old, 275 as a three-year-old, or 300 as a four-year-old or over.

Only animals with approved veterinary certificates will be admitted and, in the case of cattle, the tuberculin test is obligatory.

Australian advices testify to the return of the horse. Those who had adopted mechanical traction are finding that the horse is a more economical proposition.—*Scottish Farmer.*

Abstracts.

[**How the Antitoxic Immunity is Transmitted into the System of the New-born Child through Lactation.** Dr. Tamoh Ikeda. *Scientific Reports of the Gov. Inst. of Inf. Dis., Tokyo.* 1924, Vol. III, p. 29.]

From experiments with mares and their foals the author concludes that:—

(1) Newly-born unsuckled foals born of diphtheria-toxin-immunised mothers possess a negligible amount of anti-toxin in their blood.

(2) The milk of immunised mothers is rich in immune bodies, but these show a sudden decrease a few days after delivery of the foal.

(3) The immune bodies are absorbed unchanged through the digestive canal in new-born foals, but if the colostrum is fed to heterogenous animals this does not take place.

The author emphasises the beneficial effects of the colostrum to the foal other than as a mere laxative.

H. S. P.

[**Pathology and Therapy of Sterility and Contagious Abortion.** Dr. Joseph Kohn, Checko-Slovakia *B.T.W.*, XXXXVI, 26, p. 416, 1930.]

The subject of sterility and its causes is very much in the limelight now, owing to its economic importance. Some authors seek its etiology in calcium deficiency and would connect the incidence of the disease with certain localities, while attributing the abortion to an infectious agent. The argument is that the fœtus, especially at the height of its development, withdraws so much calcium from the organism of the dam that *locus minoris resistantiæ* is created and thus is afforded a chance for the energetic growth of the Bang bacillus. Others seek to free the intestinal tract from the abortion organism which, as an anærobe, is sensitive to oxygen, by using oxygen-originating drugs in combination with lime salts.

In the author's opinion vitamins do not play a subordinate rôle in the treatment of sterility and abortion. Avitaminosis produces in animals a pathological condition characterised by nervous disturbances and those of the endocrinal organs. These latter exercise a powerful influence upon the sexual organs. The example of Switzerland is a proof of what a far-reaching effect iodine-deficiency can produce upon sterility and abortion.

As by hypothyroidism the calcium content of the blood increases, it is indicated that iodine should be administered if calcium excretion is to be stimulated. Therefore, during gestation iodine and calcium should be given together. As Professor Frei says, "feeding of iodine gives interesting results in the form of increased number of conceptions, favourable outcome of gestation and the number of offspring."

Hitherto, abortion was treated by specific products. As the results were rather unsatisfactory, more attention was lately paid to the chemotherapy. It was necessary to find a drug which would act against many factors responsible for sterility and abortion. In the author's opinion, the drug "Abortosan Atarvst" would appear to fulfil all these conditions. It contains Arg. fluorat, Nuclein, Calcium iod, Urea, Extr. Vibur, Hydrastis, etc. One can describe "Abortosan" as a non-specific remedy with a specific action. The success of "Argotral" (a silver compound) in the treatment of abortion and sterility in Switzerland has induced the firm Atarvst to put on the market "Abortosan."

It can be safely used before service and in the middle stages of gestation.

H. F.

[**A Case of Bronchial Carcinoma in the Dog.** Dr. G. Berthold. *B.T.W.*, v., XXXXVI, No. 26, p. 417, 1930.]

This is a communication from the Pathological Institute of the hospital at Zwickau.

Patient.—A 13-year-old fox-terrier kept at Wilkau in a dust and smoke-laden mining district.

Clinical Picture.—The animal coughed for several weeks and died after a coughing attack lasting a day and a night.

Post-mortem.—In the dust-permeated, anthracitic right lung there was found in the branch of the main bronchus a polyp-like formation the size of an orange-pip, in the vicinity of which one could see numerous white nodules, the size of hazel-nut.

Histological examination proved these neo-plasmata to be of a carcinomatous structure.

It would appear that calling has a certain bearing on the incidence of bronchial carcinoma in human beings. Out of 89 cases reported by Lipschitz, 28 occurred among miners. The fact that the dog in question was kept in a mining district might account for the occurrence of this malignant tumour so rarely met with in domestic animals.

H. F.

[**On the Tuberculosis of Blood-vessels of the Horse.** Dr. A. Hemmert-Halswick, & Pol. Vet. Rat. Dr. Daasch., *B.T.W.*, v, XXXXVI, No. 23, pp. 357-362, 1930.]

After reviewing the veterinary literature on the subject between 1913 and 1918, the author observes that all hitherto described cases dealt with the tuberculous process in the endocardium and aorta, and proceeds to give an account of a few cases of generalised tuberculosis of the blood-vessels of the horse, seen at the Berlin municipal slaughter-house.

Case 1: Six-year-old mare; as foal fed on skimmed milk; badly developed, under-nourished. Save slight fever, no symptoms; could not be used for ordinary work on account of weakness; sold for slaughter as incurable. *Post-mortem findings*: Pulmonary miliary tuberculosis; in the intima of a branch of the arteria pulmonalis there were seen large and small calcareous deposits projecting in the lumen of the artery; even smaller vessels—1 mm. in diameter—were showing similar macroscopically recognizable lesions; lymph-glands felt gritty on cutting and were filled with an amorphous, greyish-yellow, calcareous, cheesy substance; heart of normal size. In this case calcifications were found not only in the lungs, heart [endocardium] and aorta, but also similar changes were discovered in all small vessels of the musculature and in the arteria pulmonalis. Tubercle bacilli were demonstrated microscopically. Inoculated guinea-pigs died from generalised tuberculosis. There are four illustrations.

Case 2: Also a six-year-old mare with generalised tuberculosis. Previous history unknown. *Post-mortem* findings as in previous case. Three illustrations. Tuberculosis bacilli demonstrated microscopically.

Case 3: As above. Histological findings illustrated by three photo-micrographs.

Summary.

In three horses with generalised tuberculosis there were found calcifications in the intima and media of the arteries and arteria pulmonalis and in the endocardium.

In the macroscopically unchanged, or of grey-brown colour, body musculature there were found microscopically minute calcified foci which, in the initial stages, were recognizable as lymphocytes, epithelioid cells and giant cells.

Infection was endogenic in the lumen of blood-vessels and ectogenic in the vasa vasorum.

A list of ten recent references is appended.

H. F.

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Subscriptions to be sent to:—

The Secretary,
Dillon Testimonial Fund,
Royal Veterinary College,
Camden Town, N.W.1.

A Mediæval Book of Animals.

Dr. James's Address to Historians.

"Members of the Historical Association assembled here this evening for the twenty-fifth annual general meeting which opened to-night with an inaugural address by Dr. Montagu R. James, Provost of Eton College, on 'The Bestiary,' a natural history of the Middle Ages," says the Special Correspondent of *The Times*, writing to his paper from Chester on January 2nd. Dr. James said that to attempt to give a neat little conspectus of the mediæval view of what we called natural history would be ridiculous, but he wished to introduce his hearers to some of the then current notions of the subject. Like the rest of the sciences, zoology and botany were cultivated to a considerable extent by the Greeks, and Aristotle was an astonishingly gifted pioneer in this field, a really faithful observer wedded to the pursuit of truth. In his "History of Animals" and his many lesser tracts on their structure and life he laid foundations which had never been uprooted. But until the advent of the printer there was no security for the preservation of what had been evolved in literature or science. Aristotle and all Greek knowledge were submerged for centuries. In the thirteenth century the wizard Michael Scot translated Aristotle's "History of Animals" from Arabic into Latin. Before that time and for long after the mediæval person had to depend for any truthful knowledge on his own eyes and on what he heard from the farmer and the huntsman. He might possibly know of Pliny's "Natural History"—a vast compilation dependent on books more than on observation. Most probably also he had Solinus, a single volume of moderate compass, but this was almost wholly dependent on Pliny and added little—and that not very trustworthy. More certainly he had Isidore's "Origines," an encyclopædia which used Solinus and a great many other writers who had no original observation.

The student of such matters, most probably a cleric or a monk, would certainly ask what bearing had the facts of natural history on any religion; or more concretely, "What can I learn from the habits of the horse or the hedgehog?" This was quite reasonable. He was interested in the universe as the work of God, and wished to draw conclusions about His nature. We ourselves thought that in proportion to our increased knowledge we got more from it. The old method was more naive. The reader in those days would accept some perfectly unfounded statement about animals and would cry, "What a lesson to all of us!" without troubling to ask if the story was true. For example, he took literally all that was said about the ant in the passage beginning, "Go to the ant thou sluggard."

Growth of the Bestiary.

Such was the point of view of the old-fashioned observation of nature. It took shape in the book called *Physiologus*, or the *Naturalist*, which was put together long before mediæval times, perhaps in the fourth century, very likely in Egypt in some community of monks. The chapters each drew a valuable moral or religious lesson from the almost always fabulous habits or propensities of an animal. This book was written in Greek and was translated into Syriac, Ethiopic and, no doubt, Coptic and Armenian. More important to us was the fact that it was also translated into Latin, and at some time in the twelfth century and by some unknown person who, Dr. James suspected, was an Englishman it was taken in hand and amplified by many additions and became what we called the *Bestiary*. The *Bestiary* was rendered into almost every European tongue, even into Welsh, Irish and Icelandic.

It had no scientific or literary merits whatever, but it was furnished at an early stage with pictures, and as a picture-book earned its popularity and took its place with three or four others which adorned the studies or church stalls of persons of quality. The pictures were the source of the animal forms used in heraldry; and this, Dr. James said, was the provenance of the griffin, the antelope, the pelican, the phoenix, the unicorn, and other such forms to be seen not only in coats of arms and crests, but on

bench ends and under the seats called misericords, in corbels, and on capitals of columns.

In the main body of his lecture, which was a running commentary with lantern slides made from illustrations in copies of the *Bestiary* preserved at Cambridge, Dr. James said he had made an examination of every English copy he could discover, limiting himself to those in which the text was in Latin and which were equipped with pictures. Over 40 English copies with pictures were known to him, ranging in date from the twelfth to the fifteenth century, but only one was as late as the fifteenth, and all the rest belonged to the twelfth or thirteenth.

Dr. James showed what the *Bestiary* depicted of the lion, the tigress, the griffin, the elephant, the crocodile, the hydrus, the dog, and, among reptiles, the basilisk. Of the fishes the most wonderful was the aspidochelone, so large and sluggish that it remained stationary for years with its back above the water.

Milk for Children.

Mr. R. Stenhouse Williams, of the National Institute for Research in Dairying, Reading, writes as follows in *The Times* of Monday last:—"Your very interesting review of Sir George Newman's report lays stress upon the danger of serious malnutrition among the children of the mining population in South Wales, but does not indicate that our children throughout the country are suffering from a similar defect, though to a much less marked degree. The evidence for this statement is derived from a variety of sources.

"Corry Mann, Orr, Gerald Leighton, Clark and others have all found that the addition of small quantities of milk to the diets of children of school age, whether they lived in their own homes or in institutions, markedly increased their weight and height. From these results it has been concluded that milk is a very valuable addition to a diet. This conclusion is sound but incomplete, since it does not take into consideration the fact that the normal diets of these children were insufficient; had they not been so, the very remarkable increases in weight, height, and general condition of the children within the comparatively short period of time during which many of the experiments were conducted would not have occurred.

"The truth of this conclusion is further emphasized by the study of the diets of 607 families which Orr has made, from which it appears that the great majority of them did not provide all the essentials for adequate nutrition, much less for growth. Helen Mackay also tells us that the babies in London and their mothers are suffering from anæmia and suggests that the infants should be given iron during the first six months of their lives.

"In the meantime the farmers and the milk industry go steadily on with their work, and daily improve the quality of milk of all kinds. Among others they offer fresh milk from tuberculin tested cows, the use of which eliminates nine-tenths of the necessity for artificial additions to our foodstuffs. Such milk is now being sold in increasing quantities throughout the country, much of it to the poor in the East End of London, but its growth is greatly retarded, chiefly, I think, from the fear of milk-borne disease which still dominates the minds of the medical profession, and the failure to realise the vital importance of fresh foods to the nutrition of the nation and its power to resist disease.

"The realization of this necessity and the determination to carry it out will do more for the farmer than artificial aids. I am, therefore, glad to join with Lady Redesdale in her appeal for the more earnest consideration of the importance of fresh foods."

At Wrexham a farmer and a butcher were each fined £30 for failing to notify to the local authority their intention of slaughtering and removing a pig to Birkenhead, and also failing to notify that the pig was diseased.

Eighteen cows on a farm near Wiesbaden were killed in one night owing to the chains round their necks coming into contact with an electric cable. Seven others were badly burned.—*Reuter.*

Notes and News.

Diary of Events.

Jan. 12th.—Meeting of the Editorial Committee, N.V.M.A., at 2 Verulam Buildings, Gray's Inn, 4.30 p.m.

Jan. 13th.—Meeting of the Derbyshire Division, N.V.M.A., at Derby.

Jan. 16th.—Annual Meeting of the Mid-West and South Wales Division, N.V.M.A., at Bristol.

Jan. 21st.—Meeting of the Lancashire Division, N.V.M.A., at Liverpool.

Professor James Macqueen.

N.V.M.A. Presidency Resigned through Ill-Health.

Lieut.-Colonel P. J. Simpson as President-Elect.

Professor Macqueen was safely and comfortably transferred from the Hampstead General Hospital to his home in Camden Road, N., shortly after Christmas. As our readers have been informed, he is now to spend a few weeks in recuperation prior to the performance of an operation, a minor preliminary operation having been successfully carried out. Professor Macqueen, we are happy to state, is steadily regaining strength, though at the time of writing the rigours of the weather preclude the possibility of his taking the air.

At the meeting of Council, N.V.M.A., held on Tuesday last, which was conducted by the past President, Mr. G. P. Male, the resignation of Professor Macqueen from the Presidency on the ground of ill-health was accepted with the greatest regret, and a vote of sympathy with him and his family was coupled with an expression of the Council's earnest hope for his complete restoration to health. At this meeting, a full report of which will appear in an early issue, Lieut.-Colonel Percy J. Simpson, of Maidenhead, was unanimously recommended for the post of President for the remainder of the year.

Consolidation of Public Health Enactments.

In pursuance of the policy of consolidating the various statutes regulating the work of the Ministry, the Minister of Health has appointed a committee with the following terms of reference "with a view to the consolidation of the enactments applying to England and Wales (exclusive of London) and dealing with (*a*) local authorities and local government, and (*b*) matters relating to the public health, to consider under what heads these enactments should be grouped in consolidating legislation and what amendments of the existing law are desirable for facilitating consolidation and securing simplicity, uniformity and conciseness."

The membership of the Committee is as follows:—

Chairman.—The Rt. Hon. The Viscount Chelmsford, P.C., G.C.S.I., G.C.M.G., G.C.I.E., G.B.E.

Members.—L. S. Brass, Esq., H. J. Comyns, Esq., Captain Ernest Evans, M.P., Sir William M. Graham-Harrison, K.C.B., K.C., Sir Frederick F. Liddell, K.C.B., K.C., Major J. J. Llewellin, M.P., E. J. Maude, Esq., C.B., Major J. Milner, M.C., M.P., Cecil Oakes, Esq., LL.M., Sir Harry G. Pritchard, L. A. J. Granville Ram, Esq., C. E. Staddon, Esq., and Lieut.-Colonel Sir Seymour Williams, K.B.E.

The Secretary to the Committee will be Mr. R. S. King-Farlow of the Ministry of Health.

R.C.V.S. Obituary.

Bayley, Alex E., 35 Denver Road, Stamford Hill, N.16. Graduated London, May 23rd, 1891; died December 29th, 1930.

. . . . . .

Porteous, Richard, Kent House, 49 Kent Road, Southsea, Hants. Graduated Glasgow, December 22nd, 1899; Died December 31st, 1930; aged 53 years.

. . . .

Smyth, William, Bridge Street, Dromore, Co. Down. Graduated Glasgow, May 29th, 1889; Died December 1st, 1930; aged 67 years.

Helping the Royal Veterinary College.

At a recent Meet of the Essex Union Hounds Mr. R. A. Philp, F.R.C.V.S., and the Misses Philp, by the kind permission of the Master (Mr. E. L. Heatley) made a collection in support of the Rebuilding and Endowment Fund of the Royal Veterinary College, the result being the handsome sum of £15 17s. 0d. This has been added to the Appeal Fund which the Editor of *Horse and Hound* started a few months ago, and which has already reached the sum of £1,176 13s. 0d.

A similar appeal made by Captain H. A. Jaffray, the Joint-Master of the Brocklesby Hounds, on Boxing Day amongst the Members of the Public who attended the Meet, resulted in a cheque for £15, which was forwarded through the Principal of the College and added to the *Horse and Hound* Appeal List.

We commend this idea to the well wishers of the College as worthy of being copied, not only at the hunting meets, but on other occasions where there are assemblies of sporting and animal-loving people.

Army Promotion Examination.

Majors Danels, L., Murray, C. A., and Steevenson, G. F., and Captain O'Kelly, E., Royal Army Veterinary Corps, were amongst the successful candidates at the examination (in written subjects) of officers, with a view to promotion in the Regular Army, which was held at Home Stations last October.

Correspondence.

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

Members R.C.V.S. whose Addresses are Wanted.

To the Editor of the Veterinary Record,

Sir,—I should be glad if you would kindly publish in the *Veterinary Record* the following list of members whose addresses are unknown in this office:—Aulton, R. M., Borthwick, J. D., Brew, J. A., Carron, P., Collyer, J. B., Cooper, D., DeVine, E. J., Devlin, W. A., Eardley, F. J., Fulton, J. D., Hamilton, J. R. R., Henderson, R., Hesketh, H. K., Holden, G. B., Hunt, F. D., O'Neill, O. A., Paton, J. C., Percy, H. W., Porteous, R. K., Shaw, T. A., Simpson, C. S., Slipper, T., Smart, A. C., Somerville, T. V., Stevenson, W., Sturdy, W., Tufts, S. R., Whigham, W. B., White, J. H. M., White, R. S., Yardley, G. M.

The Register for 1931 is now in the Press, and all changes of address should be sent to me immediately, if it is desired to include them in the new edition.

Yours faithfully,

Fred Bullock, *Secretary*.

Royal College of Veterinary Surgeons,
10 Red Lion Square, London, W.C.1.

The "History of Veterinary Literature."

To the Editor of the Veterinary Record.

Sir,—May I supplement your review of the late Sir Frederick Smith's Third Volume of the "History of Veterinary Literature," by extracts from a statement drawn up by the author himself, showing what he intended the scope of the work to be? In a letter to the Editor of the *Veterinary Journal* he said:—

"The History covers the years 1800-1869, a period of great development. No sharp line separating one period from another can be drawn in history, but the eradication of cattle plague in 1869 is a mile-stone. It gave rise to a new and technically better-educated profession. . . .

"The book will contain a biographical notice of the principal writers and an appreciation of their work. It will record every veterinary work printed during the period, the worthless being distinguished from the useful. . . The notices of all books excepting those of pre-eminent merit will be confined to one or two lines.

"The progress made by the profession from 1800-1869 is the next strong feature. This was accomplished by the general practitioner, through the pages of *The Veterinarian*. It was this organ which educated the profession in England. . . . I have extracted the titles of the work performed by this valiant band, and stated where it can be found. In a few words I have shown the additions which each man made to our knowledge. The profession to-day is living on and by the observations of these workers of the past and does not know it. We shall hand down their names and work to posterity. . . . "

Such was the author's generous plan.

The publication of the manuscript for the whole of the period mentioned was, however, found to be impossible, for two reasons. First, the doubt whether sufficient copies would be purchased to pay for the cost of printing, and second, the failing health of the author, which prevented his completing the revision of the latter half of the MS. The compromise arrived at it is thus referred to in the preface to Volume III:—

"The present Volume carries the History of Veterinary Literature in this country to the year 1823. It had been intended to include in one volume the whole of the story from 1800 to 1869, but though the material has been prepared, it has not been found possible at the present stage to arrange for the publication of the whole of it.

"The Editor and Publishers of the *Veterinary Journal* are cordially thanked for undertaking the publication of this section; their generosity has saved it, as it did the Veterinary History of the Eighteenth Century, from being lost to the profession for which it was written. Whether the period 1824-69 will be published depends upon the reception this part receives."

The profession has, it will be seen, acquired this published history without cost. There was first the immense uncompensated labour of the author, and next the willing co-operation of the Publishers.

The remainder of the MS was entrusted by Sir Frederick Smith to me, and it was our hope that some day the complete history could be published. I think all will agree that before any profession can claim a recognised standing amongst learned bodies it must be in a position to point to its past achievements for its warrant to be so accepted. The veterinary profession would have lacked even the outline of the story of its development if it had not been for the devoted labour of Sir Frederick Smith.

But the completion of the history can only be accomplished if means are found to pay for its publication. Could we more worthily honour his name than by continuing the work he began so well?

Yours faithfully,

Fred Bullock.

10 Red Lion Square,
W.C.1.

January 5th, 1931.

The Editor acknowledges the receipt of the following:—

Report of a meeting of the University of London Animal Welfare Society, from Captain C. W. Hume, Hon. Secretary.